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INTERNATIONAL CONGRESS OF ZURICH

ON THE

CONSTRUCTION OF BRIDGES, BUILDINGS AND VARIOUS WORKS.

(September 1926.)

The construction of important Engineering works in Switzerland from a theoretical and practical standpoint.

(Papers presented by F. Ackermann, J. Brunner, A. Bühler, A. Dumas, H. Frölich, F. Hübner, R. Maillart, A. Meyer, H. Nater, A. Paris, M. Ritter, A. Rohn, M. Ros, E. Stadelmann, H. Studer, P. Sturzenegger.)

By A. RONSSE,

CHIEF ENGINEER OF THE NATIONAL BELGIAN RAILWAYS COMPANY,

and

R. DESPRETS,

PRINCIPAL ENGINEER ON THE SAME COMPANY,

PROFESSOR OF BRUSSELS UNIVERSITY.

The articles presented at this Congress, which was presided over by Dr. A. Rohn, are of exceptional interest owing to the diversity of the subjects dealt with and on account of the contribution which they make to the technical side of civil engineering. Even the best informed engineer will find on reading the various reports and papers quantities of information the fruit of far reaching investigations or the result of bold schemes masterly carried out. It is impossible to give here even a brief account of the large number of reports presented; these are published *in extenso* and may be obtained on application to the Testing of Materials Laboratory at Zurich (1). The authors are outstanding in the scientific world and have demonstrated the completeness of their knowledge of building construction. Professor Rohn, in his paper read before the Congress, describes and analyses many important works carried out in Switzer-

(1) Leonhardstrasse, 27. — Price : 65 francs (Swiss currency).

land and describes, in a number of cases, how bridges have been strengthened, as for example, the bridge over the Aar at Berne. The author's paper is illustrated by numerous photographs, drawings and diagrams.

Generally speaking the published papers contain a number of photographic views artistically reproduced.

Dr. Ros, Director of the Federal Testing of Materials Laboratory attached to the Polytechnic School of Zurich, deals with the question of secondary stresses in rivetted lattice girders and with the buckling under compression of struts either with or without initial eccentricity — see the more detailed account which follows.

The same author gives an interesting report on trials on the loading of reinforced concrete arches and analyses the results obtained. In collaboration with Mr. Eichinger, an Engineer of the Federal Laboratory at Zurich, a report is presented to the Congress on the tests carried out by the authors in order to throw further light on the risk of fracture of steel used for structural purposes. Dr. Ros's contribution to the work of the Congress is completed by other papers.

Among these latter, one which is of special interest is that dealing with the causes of the masonry piles of the Sitter Railway viaduct having moved from the vertical and the means employed to overcome this trouble.

Mr. Bühler, Engineer Chief of the Swiss Federal Railway Bridge Department, deals with the question of impact — see summary given below — with comments and particulars of the various bridges on the Swiss Federal Railways. This report is illustrated by photographs which give the paper a special interest. The same author has also a report on the condition of some reinforced concrete bridges constructed in Switzerland.

Dr. Brunner, Engineer, gives a very complete account of Swiss wooden bridges. The photographic views illustrating this article are of special artistic interest.

Mr. Hans Studer, Engineer of the Rhetian Railways deals with the question of the stability and the construction of large span arches. The numerous photographs of bridges show that the Rhetian Railways have systematically adopted masonry bridges, thereby utilising local resources. On the Gothard line, on the other hand, steel bridge work is almost exclusively employed.

The report on the reconstruction of the Day-sur-l'Orbe viaduct, on the Lausanne-Vallorbe line, by Mr. H. Frölich, Engineer of the Swiss Federal Railways, describes how a steel bridge which had become too weak, in view of the electrification of the Swiss Railways, was replaced by a concrete arch without interfering with the traffic.

A similar work is now being carried out at the Grandfry viaduct near Friburg.

A number of other papers presented to the Congress, of high scientific and pratical interest, should be mentioned, especially papers by Mr. Stadelmann, Engineer of Zurich, Mr. Max Ritter, Engineer of the firm Ed. Zublin & Co., Professor Dumas of the Lausanne University, Mr. Meyer, Engineer of the Swiss Federal Railways, Mr. Nater, Engineer of the Swiss Federal Railways, Mr. Maillart, Engineer of Geneva, Mr. Hübner, Engineer of Berne and Professor Paris, Engineer, etc.

Spannungsverteilung bei Füllungsgliedern von Brücken auf Grund von Messungen

(Experimental investigation of the distribution of stresses in the diagonal members of multiple lattice girders),

By A. MEYER, Engineer of the Swiss Federal Railways' Headquarters.

In this article the author gives the measurements of stresses in the diagonals of multiple or simple lattice girders with the object of determining experimentally the distribution of stresses in the different members on one single vertical section or along one single member.

The railway bridges on which tests were carried out were :

1. The multiple lattice girder over the Linth Canal near Weesen;
2. The multiple lattice girder at Cully (Lausanne-Saint-Maurice line);
3. The wooden bridge over the Rhine near Ragaz;
4. The approach span of the bridge over the Reuss near Mellinger;
5. Braced girder. Trübbach bridge;
6 and 7. Bridge over the Linth at Däniberg;

Bridge over the Grosse Emme near Burgdorf;

Simple lattice V girders.

Conclusions. — The stresses determined experimentally agree the more closely with the calculated stresses as the latticing is made simpler. The secondary stresses are unimportant in simple lattice girders.

The older multiple lattice bridges do not behave as irregularly as has been sometimes considered.

In multiple lattice girders the shear stress is distributed between the members in the proportion of their sections. A distribution proportional to the number of the members is not very closely borne out by the results of the actuel experiments.

Technische Kommission des Verbandes Schweiz. Brücken und Eisenhochbaufabriken (T. K. V. S. B.)

(Technical Committee of the Swiss Association of Steel Work Constructors.)

Die Knicksicherheit von an beiden Enden gelenkig gelagerten Stäben aus Konstruktion's Stahl

(The resistance to buckling of mild steel struts jointed at both ends.)

New researches on the buckling of compression members, either with or without initial eccentricity, have been carried out by Professor Ros and Mr. Brunner, based on the new theoretical considerations of Engesser and von Karman on the substitution of a coefficient of elasticity which varies with the stress in the metal for the constant modulus of elasticity used in Euler's formula. The results of the tests agree well enough with the theoretical calculations.

From a practical point of view, the authors lay down certain conclusions of special interest. We quote the following :

The eccentricity of the loading decreases the buckling load to a greater extent for short stiff members than for members which are long compared with their cross section.

In order to allow for the unavoidable eccentricity in the loading of the members due especially to imperfect workmanship, to the variable nature of the metal (imperfect homogeneity) to friction in the joints at the extremities, to partial building in and to the secondary stresses which may in lattice girders be 20 % of the primary stresses, it is desirable to check the buckling resistance of the members in compression, assuming an initial eccentricity in loading *equal to one quarter of the width of the central web.*

For members of average length compared with the cross section

$$\left(\frac{l}{i} \text{ ranging from 40 to 100}\right),$$

building in the ends only increases the resistance to buckling by a small proportion.

It is therefore recommended that, in view of the deformations of the joint gusset plates, the theoretical length of the members should be used in calculating their resistance to buckling and that no coefficient of reduction (as for example : 0.8 of the length as is sometimes adopted), should be used.

Stosswirkungen bei eisernen Eisenbahnbrücken

(*Impact effects on railway bridges*),

By A. BÜHLER, Chief Engineer of the Bridge Construction Department of the Swiss Federal Railways.

Introduction. — The author points out that the question of the dynamic action of rolling loads on steel bridges, although the object of many investigations and extended experimental work, is not yet completely solved.

It is well recognised by bridge engineers that the loads always act in a state of motion and not statically, although it is the general practice to calculate bridges under static loads only.

Certain existing rules take into account the effect of impact, although for the most part the additional load due to dynamic action is covered by the factor of safety, which ought rather be a termed factor of uncertainty.

America and the Anglo-Saxon countries have led the way in the determination of impact coefficients and their introduction into calculations, while Germany has followed their example.

The dynamic effects may be considered :

1. as reducing the allowable working stress ;
2. as increasing the loading.

The safe working stress may be limited in accordance with Wöhler's conclusions, which were as follows :

1. A member may be subjected to an infinite number of repeated stresses between zero and a definite figure, provided that the latter does not exceed half the ultimate strength ;
2. In the case of alternating stresses,

the upper stress limit should not exceed one third of the ultimate strength.

These researches have been extended by Bauschinger, Baker, Fairbain Osborne, and recently by the Illinois University Laboratory and by the National Physical Laboratory at London. One is led to adopt the following expressions for maximum stresses :

$$\sigma_\beta' = \frac{\sigma_\beta}{2}\left(1 + \frac{S_{min.}}{S_{max.}}\right) \text{ (Wöhler)}$$

$S_{min.}$ and $S_{max.}$ having the same signs and

$$\sigma_\beta'' = \frac{\sigma_\beta}{2}\left(1 - 0.5\,\frac{S_{min.}}{S_{max.}}\right) \text{ (Launhardt)}$$

when $S_{min.}$ and $S_{max.}$ have opposite signs.

The determination of the *dynamic augments* and *impact coefficients* is obtained by considering the elastic limit as the limiting stress of the material. This method of introducing dynamic effects into the calculations has been strongly supported by Waddell. The results noted appear to show that the idea of supplementary stresses due to repeated loading should be excluded, at any rate where the stresses are below the elastic limit. It would appear that the determination of impact coefficients is therefore very urgent and very necessary.

Impact coefficient. — This coefficient should take into account all the elements tending to cause the stresses produced by *a static load* (that is to say, at very low speed), *to differ* from the stresses produced by a moving load.

The following must be considered :

1. Increase in loading due to the deflection of the girders ;

2. A time lag in the transmission of stress throughout the length of the bridge. Deformations will be propagated with the maximum velocity of the propagation of sound in steel, that is 5 300 metres (17 390 feet) per second. This consideration, while negligible for small bridges, may be of importance on large bridges such as the Forth bridge ;

3. Increase in stress due to the condition of the track, as for example the presence of rail joints ;

4. The effect of flats on the tyres producing shocks on the rail ;

5. The influence of lack of balance in a vertical plane due to the reciprocating parts being balanced in a horizontal plane. This effect will be at its maximum when the period of the rotation of the wheels synchronises with the period of natural vibration of the bridge ;

6. Effects due to the construction of the bridge itself.

The author refers to certain theoretical works and quotes the results of the more important tests on the question of impact coefficients.

Conclusions. — 1. In making accurate bridge calculations, it is important to take into account dynamic effects ;

2. Impact coefficients depend both on the construction of the bridge and on its state of repair as well as upon the vehicles. These coefficients are higher for old bridges than for new bridges.

3. In general the impact coefficient should not be directly proportional to the speed. These coefficients are a maximum where the period of the rotation of the wheels synchronises with the natural period of the bridge. For large and medium spans, this critical speed may be attained. For short spans (17 m. [55 feet]) as a rule this speed is not attained. The other factors affecting the coefficient can then be predominant;

4. The approximate formulæ contain

the length of the span as a variable; a better approximation would be to take the *loaded length* — in particular for members under alternating stress.

The more satisfactory method would no doubt be to assume supplementary isolated loads in addition to the axle loads; these loads would depend upon the engine and upon the construction of the bridge;

5. In every day practice it may be considered that the Pencoyd formula gives satisfactory results. For small spans it gives too low results. One should then adopt the « American Engineering Association's 1916 formula;

6. For the purpose of clear and accurate calculations, it would be well to establish a formula based on the various constituent factors;

7. The dynamic coefficient may be decreased by using long rails with welded joints on wooden sleepers with stringers placed well apart. The adoption of continuous longitudinal girders, ballasted track up to spans of 30 m. (98 feet), rigid floor members and effective wind bracing to ensure the rigidity of the whole, also decrease the dynamic coefficient. Open top and skew bridges should be avoided for this reason.

The tests made up to the present afforded a large amount of information which is, however, difficult to use. In order that the question may be really carried to a solution, methodical tests ought to be made wherein all the factors may be separated and determined. The author believes that only by determining the tension stresses excluding measurements of the deformations of the whole, will results of value be obtained.

* * *

This paper by the eminent Swiss expert, states very clearly the actual situation as regards the extremely important question of impact effects on railway bridges. It is accompanied by a series of very interesting diagrams.

Nebenspannungen infolge vernieteter Knotenpunkt Verbindungen eiserner Fachwerk Brücken

(*Secondary stresses in lattice girders*),

By Professor M. ROS, Director of the E. M., P. A., Zurich.

Professor Ros's work on secondary stresses in rivetted lattice girders has been undertaken at the request and under the auspices of the Technical Committee of the Union of Swiss Structural Engineers.

This question, although having received much attention, is one which is still imperfectly understood, and Professor Ros' theoretical and experimental work is very important.

We will briefly summarise below the principal points dealt with in his paper.

1. *Historical.* — The early lattice girders were constructed both with pin joints (Crumlin valley bridge in England, 1853) and with rivetted joints (bridge over the Vistule at Dirschau-bridge over the Nogat, near Marienburg, 1850-1855).

In Switzerland, no pin joint lattice

girders were constructed. The first steel bridges had solid plate web girders (French influence in Southern Switzerland) or multiple lattice girders (German influence in the North). As example of the two types, we may quote the Paudèze viaduct on the line from Lausanne to Villeneuve and the railway bridge over the Linth canal, near Weesen, on the line from Zurich to Chur.

K. Culmann (1821-1881), Professor of the Federal Polytechnic School of Zurich, after investigations in England and America, strongly advocated the adoption of simple lattice girders instead of plate web or multiple lattice girders.

To Culmann is due the credit for proposing the method of calculating simple rivetted lattice girders by assuming them to be provided with imaginary pin joints. In 1878, Professor H. Manderla of Munich proposed a theoretical method of calculating the secondary stresses set up by the rigidity of the joints. His lengthy and tedious calculations were seldom applied. Various German scientists added their contribution to the theoretical solution of the problem. We may mention after Manderla (1878), Engesser (1879), Asimont (1880), Winkler (1881), who were followed by Ritter (Zurich, 1885), H. Muller Breslau (1885), Th. Landsberg (1886), O. Mohr (1892), Jacquier (1897), Gehler (1905) and Hartmann (Vienna, 1919).

The theoretical problem consisted in determining the movement of the members at the joints consequent on the deformation of the triangles. In Manderla's theory, followed by most other investigators, the angles of deformation are directly determined. In Mohr's theory, the angular movement at the joint is expressed as the difference between the angle of rotation of the common joint for all the adjacent members ending thereat and the angles of rotation of each of the members.

In practice, numerical calculations are always lengthy and laborious.

In 1901, Professor Patton, of Moscow, carried out these calculations for nineteen cases of lattice girders and established in three cases influence lines for the secondary stresses.

Winkler (1881), Patton (1901) and Hartmann (1919) were led to deduce from theoretical considerations some practical conclusions of importance to bridge builders. They recognised in particular that the importance of secondary stresses increased with the complexity of the lattice work approximately in the following order :

1. Simple V lattice without uprights;
2. Simple V lattice with supplementary uprights ;
3. Multiple lattice work.

Professor Patton has carried his deductions further and established the magnitude of the secondary stresses as fractions of the principal stresses, the governing factor being the slenderness of the member (ratio of the length of the member and the distance in cross section between the centre of gravity and the outermost and most highly stressed fiber).

The first experimental measurements of secondary stresses were made by Dupuy (1878) on the Erdre viaduct, in France, and by Fränkel, in Germany (1881-1887), on the Schmiedeberg railway bridge.

These experiments having shown that the secondary stresses were far from negligible, *Gerber, in 1881, returned to the use of jointed bridges.* An example of this type is the 40-m. (131-foot) span railway bridge over the Ellhofertabel,

near Rötenbach. Shortly afterwards, on the advice of Winkler, Manderla made some tests on a *pin jointed bridge* of 54 m. (177 foot) span constructed by Gerber, near Waltenhofen, in 1883. He recorded high secondary stresses corresponding to a coefficient of friction as high as 0.31 at the joints. *Gerber, there upon abandoned the jointed system and definitely returned to the use of girders with rivetted joints.*

The first systematic measurements of secondary stresses were carried out by Mr. Mesnager (1889) on two bridges belonging to the Orléans Railway : the Cognac bridge on the line Nontron-Sarlat and the bridge over the Beuvron, near Celletier, on the line Saint-Aignan to Blois.

The high stresses found by Mr. Mesnager led him to invent the system of elastic plate joints which bear his name.

We should also mention the tests by Professor Gehler on the railway bridge at Elsterwerda.

At the same time that Professor Patton was carrying out his researches and tests in Russia, the Swiss Engineer Ackermann showed by calculation and experimental measurements on the railway bridge at Thusis on the Rhine, that the secondary stresses were diminished as a result of the redistribution of stresses due to the flooring and the stiffness of the members. Ackermann was able, by suitable methods of erection, to eliminate the secondary stresses due to the dead weight of the bridge.

In America, great attention has been given to secondary stresses in recent years. In the construction of the Sciotoville bridge (1913-1916) in accordance with Lindenthal's plans, precautions were taken to eliminate them as far as possible. The same was the case at the Hell Gate River bridge at New York.

American conclusions tend, in any case, to abandon the articulated system in favour of rivetted joints, the former giving rise to considerable secondary stresses due to friction.

The Swiss Technical V. S. B. Committee carried out experimental tests and complete theoretical calculations on *fifteen important bridges* between October 1917 and June 1922.

Method of calculation. — In Mohr's method, the unknowns are the angles of rotation of the joints φ. In a lattice girder with n joints it is necessary to determine n unknowns $\varphi_1 \ldots\ldots \varphi_n$. If we know the angles of rotation of the members ψ, the secondary moments are given by the expression :

$$M_{n,n+1} = \frac{2EJ_{n,n+1}}{l_{n,n+1}} \left\{ 2\tau_{n,n+1} + \tau_{n+1,n} \right\}$$

where

$$\tau_{n,n+1} = \varphi_n - \psi_{n,n+1}$$

and finally

$$M_{n,n+1} = \frac{2EJ_{n,n+1}}{l_{n,n+1}} \left\{ 2\varphi_n + \varphi_{n+1} - 3\psi_{n,n+1} \right\}$$

The influence lines of the angles of rotation of the joints and the angles of rotation of the members show that the angles of rotation of the joints are approximately the mean of the angles of rotation of the adjacent members ending thereat.

This very important conclusion considerably simplifies the calculation of the angles of rotation and therefrom of the secondary stresses.

This conclusion may be expressed, for example, by the relation :

$$\varphi_n = \frac{\sum_{n,n+1}^{n,n+m.} \psi_{n,n+m} \frac{J_{m,n+m}}{l_{n,n+m}}}{\sum_{n,n+1}^{n,n+m} \frac{J_{n,n+m}}{l_{n,n+m}}}$$

The Committee have examined successively the influence of various factors setting up or affecting the secondary stresses :

1. Secondary stresses in the case of the symmetrical attachment of members having a constant moment of inertia ;

2. Influence of an initial eccentricity of members ;

3. Influence of an isolated load on one member ;

4. Influence of a variable moment of inertia ;

5. Influence of the discontinuity in the neutral axis of a member in consequence of the attachment of other members, bracing gussets, etc. ;

6. Influence of deflection due to secondary moments ;

7. Influence of the shortening of members by gusset attachments ;

8. Influence of the deformation of end gussets ;

9. Influence of secondary stresses on the primary stresses and on the deformation of the girders.

Conclusions. — The more important conclusions of the tests and calculations are as follows :

1. The measurements of the linear *deformation* of the members at the joints give more reliable results than measurements of the angles of deformation ;

2. The secondary stresses obtained by experiment agree well with the calculated secondary stresses ;

3. The total stresses measured show that secondary stresses exist in the two normal directions of bending. The members of lattice girders belong, not only to the plane systems of the girders, but also to the system of the kind formed by the two principal girders and by the cross girders, flooring and wind bracing.

However, the secondary stresses in transverse section are as a rule small, only reaching important values, in special cases, as for example, open top bridges ;

4. The more complicated the system of latticing, the greater the discontinuities in the layouts of the members and in the transmission of the loads, the greater will be the differences found between the calculated and mesured values of the secondary stresses ;

5. The assumption that the gussets are completely rigid and that the members are perfectly built in into the gussets is too unfavourable ;

6. The influence of the deformation of the gussets is difficult to exactly determine. It may be taken into account by the following method :

The secondary moment calculated on the theoretical length of the member is multiplied by the ratio of this length to the actual length between the gusset attachments. It is assumed that a moment of this value exists at the connection of the member to the gusset ;

7. An eccentric attachment of the members, generally speaking, increases the secondary stresses. It should therefore be avoided.

Rigid gussets have a favourable effect in distributing the moments and stresses in the members ;

8. In cases where the elastic limit is exceeded in the outer fibers at the attachment of a member, the secondary stresses decrease very rapidly. The latter have then no real influence on the strength of the bridge. There is no justification in reducing the theoretical buckling length, this should only be done in cases where there are secondary moments at the extremities acting in opposite directions tending to bend the member into an S form ;

9. The influence of the rigidity of the flooring is very marked, not only on account of the decreased dynamic effect, but also in view of the decreased deformation of the whole giving rise to smaller secondary stresses ;

10. By adopting a *simple lattice* formation with *well centered* attachments, having ratios of length to moment of inertia ranging from 60 to 15 in the plane of the girder and of sufficient rigidity in the transverse plane, the secondary stresses will not be excessive.

The secondary stresses of the same sign as the principal stresses will amount on the average to *15 to 20* % of the latter.

The influence of the rigidity of the joints on the principal stresses and on the deformation of the systems assumed to be pin jointed may therefore in fact be neglected.

[625 .143.3]

A diagnosis of rail failures,

By T. H. SYMINGTON.

Fig. 1, p. 1043.

(*Railway Age.*)

One of the most difficult problems for complete and correct diagnosis in modern railroad operation has to do with rail failures. The subject is so complex that it would seem essential to diagnose the trouble properly, so that effective remedies can be applied.

An article in the *Railway Age* of 16 July 1927 (1), « Stress in rails has important bearings on failures » shows a definite relationship between static axle loads in rail sections of 100 and 115 lb. and the resulting rail failures. It is evident that the girder strength of rails must be sufficient to carry existing equipment safely. Some railroads are now using 130-lb. rails on main line track and a rail section of 150 lb. per yard is being considered to further increase the girder strength.

No one maintains that the girder strength of a rail is its only necessity, and no one can say what the future maximum section standard rail will be. It is well known that it is much more difficult to obtain uniformity in the steel of the heavier rail sections than in the old lighter sections.

Modern research has led to locomotive design that minimizes the dynamic augment incident to the main locomotive driving wheels and a great deal of study is being given to excessive pressures incident to the wheels of heavy freight cars. These excessive car wheel pressures occur when car roll by some means is not prevented.

W. P. Borland, Director of the Bureau of Safety, Interstate Commerce Commission, in the *Railway Age* of 26 December 1925 (1), is quoted as follows :

« The problem is one of physics, as rails will fracture when exposed to strains which are beyond their ability to endure, the same as other engineering members will. The trouble seems to have been in the failure to recognize the influence and effect of intense concentrated loads, which are peculiar to and always present where loads are carried on wheels. Girder strength of the rail is not the prime consideration. If it were, rails would fracture from the base instead of the interior of the head. The crux of the problem is in the intense impinging pressures at the area of contact

(1) See *Bulletin of the Railway Congress*, November 1927 number, p. 1003.

(1) See *Bulletin of the Railway Congress*, August 1926 number, p. 697.

between the tread of the wheel and the head of the rail... Hope for improvement lies in the direction of finding a steel having a higher limit of endurance against present track strains, one which has a margin above any known grade of steel familiar to the arts. There is no hope for immunity against the display of transverse fissures in present track structures exposed to current strains.

« A state of finality undoubtedly admits of being reached in the endurance of steels. If judgment is at fault in the belief that the prevention of transverse fissures under present wheel loads on present grades of steel is impossible, a great service will be performed by any person who will present conclusive evidence which will correct that judgment. »

In the 17 April 1926 issue of the *Railway Age*, James E. Howard, engineer-physicist, Bureau of Safety, Interstate Commerce Commission, is quoted :

« It is not to the point whether one rail displays a transverse fissure and another does not, but why does a fractured rail fracture ? Where wheel pressures are mentioned reference is made to the influence and effects of the intense impinging pressures at the contact surfaces of the treads of the wheels and the running surfaces of the heads of the rails. Here lies the crux of the situation, and here is located, practically, the entire rail problem. »

Impinging bearing stress on the rail

The above conclusions have nothing to do with the girder strength of the rail. It seems important, therefore, to differentiate between the two kinds of high vertical stress to which rails are subjected : first, bending stress in the rail as a beam; second, impinging bearing stress on the head of the rail. Either of the stresses, or a combination of both, may result in ultimate rail fractures. Transverse stresses in rails from wheel flanges are not under consideration.

It is difficult to diagnose accurately dynamic impinging pressures, because we have become accustomed to gage the extent of shocks by sound. A flat wheel makes a lot of noise and we assume that it is doing an immense amount of damage. When the springs of a heavy freight car go solid there is no sound to indicate the tremendous impinging stress put into the small contact area on the rail head by the 33-inch wheels.

The diagrams give a comparison of the wheel pressures and unit bearing stresses in rails at the impinging contact between locomotive and freight car wheels.

The bottom diagram, which deals with wheel loads irrespective of the areas of impinging contacts, shows that the badly balanced locomotive driving wheel puts a 40 % greater bending stress in the rail indicated at A than the bending stress at B from a 70-ton car wheel just before its 80 000-lb. capacity five-coil springs go solid. These are the forces we must consider in connection with the girder strength of the rail.

The top diagram deals with unit bearing stresses on the rail head from locomotives and cars. This bearing stress from a badly balanced locomotive driving wheel is shown at C. The bearing stress from a 70-ton car wheel just before its 80 000-lb. capacity five-coil truck springs go solid, is indicated at D and is 25 % greater. If we use seven-coil truck springs of 112 000 lb. capacity, and if the car roll is sufficient, the car wheel bearing stress on the rail head just prior to spring closure would be 75 % greater than the bearing stress on the rail head resulting from the 60 000-lb. locomotive driving wheel re-action. Similarly, 89 000-lb. capacity six-coil truck springs on 55-ton cars before closure give a wheel bearing stress on the rail head that is 38 % greater than the same unbalanced locomotive driver.

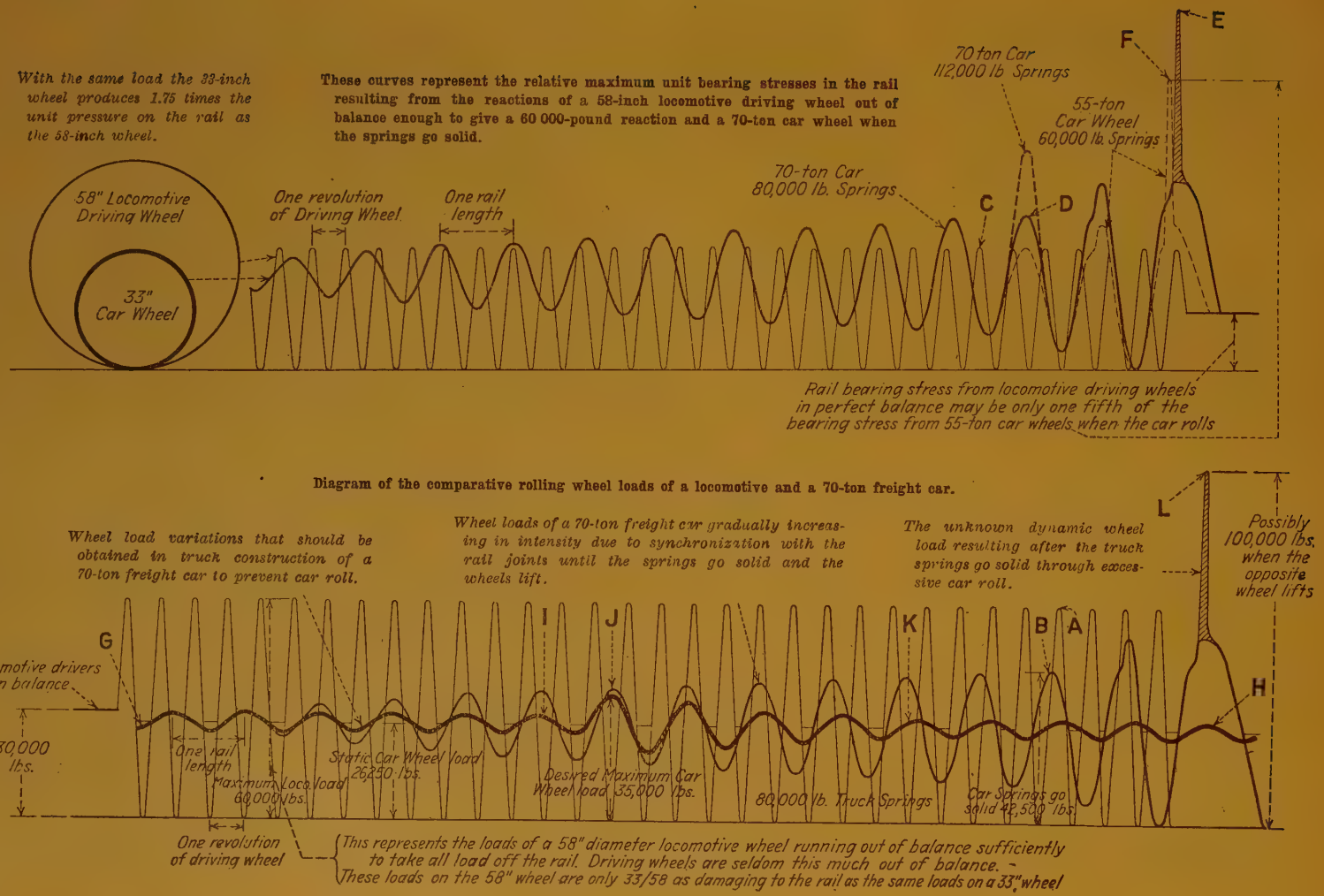

With the same load the 33-inch wheel produces 1.75 times the unit pressure on the rail as the 58-inch wheel.
These curves represent the relative maximum unit bearing stresses in the rail resulting from the reactions of a 58-inch locomotive driving wheel out of balance enough to give a 60 000-pound reaction and a 70-ton car wheel when the springs go solid.
70 ton Car 112,000 lb Springs
55-ton Car Wheel 60,000 lb. Springs
70-ton Car 80,000 lb. Springs
58" Locomotive Driving Wheel
33" Car Wheel
One revolution of Driving Wheel
One rail length
E
F
C
D
Rail bearing stress from locomotive driving wheels in perfect balance may be only one fifth of the bearing stress from 55-ton car wheels when the car rolls
Diagram of the comparative rolling wheel loads of a locomotive and a 70-ton freight car.
Wheel load variations that should be obtained in truck construction of a 70-ton freight car to prevent car roll.
Wheel loads of a 70-ton freight car gradually increasing in intensity due to synchronization with the rail joints until the springs go solid and the wheels lift.
The unknown dynamic wheel load resulting after the truck springs go solid through excessive car roll.
Possibly 100,000 lbs. when the opposite wheel lifts
L
G
I
J
K
B
A
H
Locomotive drivers in balance
30,000 lbs.
One rail length
Maximum Loco Load 60,000 lbs.
Static Car Wheel Load 26,250 lbs.
Desired Maximum Car Wheel load 35,000 lbs.
80,000 lb. Truck Springs
Car Springs go solid 42,500 lbs.
One revolution of driving wheel
This represents the loads of a 58" diameter locomotive wheel running out of balance sufficiently to take all load off the rail. Driving wheels are seldom this much out of balance.
These loads on the 58" wheel are only 33/58 as damaging to the rail as the same loads on a 33" wheel

Fig. 1. — Comparison of wheel pressures and unit bearing stresses in rails.

The last statements mean that the bearing stress on the rail head from a 70-ton car wheel, just before its 112 000-lb. capacity seven-coil truck springs go solid, is equal to the bearing stress on the rail head from 105 000 lb. on a 58-inch locomotive driver; also the bearing stress on the rail head from a 55-ton car wheel, just before its 89 000-lb. capacity six-coil truck springs go solid, is equal to the bearing stress on the rail head from 82 800 lb. on a 58-inch locomotive driver. A locomotive main driving wheel with normally 30 000 lb. load on the rail will apply only approximately 60 000 lb. of load when it is enough out of balance to take all the load off the rail. Obviously, if the above high car wheel bearing stresses were bending stresses, the entire roadbed would be quickly destroyed.

It is evident that, if 112 000-lb. capacity seven-coil truck springs are used instead of 80-000 lb. capacity five-coil truck springs on 70-ton cars, the high shock bearing stress on the rail head E is better avoided, unless cumulative roll with 80 000-lb. capacity five-coil truck springs is prevented. The same is true regarding the shock bearing stress F from 55-ton cars with 89 000-lb. and 64 000-lb. capacity truck springs respectively.

Referring again to the bottom diagram, the sinuous line G-H shows a normal variation in wheel load of a 70-ton freight car with 80 000-lb capacity five-coil truck springs on a normally maintained track without cumulative car roll. This sinuous line G to I shows a variation in wheel pressures corresponding to a movement in the truck springs of 1/4 inch. This is usual on good track. Point J indicates a wheel pressure of 35 000 lb. which corresponds to an occasional movement of 3/4 inch in the truck springs. The line from J to K shows this high vibration quickly diminishing to the normal vibration shown from K to H. With cumulative roll, this 35 000-lb. pressure may increase to the shock peak L, of possibly 100 000 lb. An instantaneous dynamic pressure of 100 000 lb. from a 33-inch wheel would put a bearing stress on the rail head equal to an instantaneous bearing stress of 175 000 lb. from a 58-inch locomotive driver. This comparative bearing stress of 175 000 lb. must be increased in the same proportion as the penetrative hardness of a chilled iron car wheel exceeds the penetrative hardness of a rolled steel locomotive driving wheel tire. These figures are not based on theory, but on well-known principles of physics and cannot be ignored.

Rigid body cars on curves.

The problem on curves with rigid body cars is not one of impinging pressures but of derailments. Such derailments are caused always by high pressure of the wheel flanges against the rail, accompanied by an unloading of the truck springs on the same side of the truck. If high flange pressure against the rails could be eliminated, rigid body cars with wood blocks instead of springs could be run safely around any curve. The supports of the rigid cars would then be on any three points on the two body bolsters each centre plate being either one or two points, depending on whether or not it is cocked. The maximum load on the rail from one wheel would occur when the entire weight of one end of the car came on one side bearing. This load could not exceed 33 600 lb. for a 55-ton car. This condition would not absorb all the travel in any one of the standard 64 000-lb. capacity four-coil truck springs on a 55-ton car.

We must conclude that the locomotive driving wheel is the worse offender in stressing the rail as a beam. On account of its diameter however, its large bearing area on the rail head is within safe limits. The 33-inch car wheel, with its small bearing area on the rail head, is obviously the worse offender in producing high impinging bearing stresses on

the rail head. These bearing stresses, coupled with its normal bending moment, make the car wheel the largest factor in damaging the rail.

It seems imperative, therefore, that in order to help the rails, we first insure against the car wheel peak shock stresses and then reduce the high car wheel impinging pressures by minimizing car roll.

Only the wheels of one pair of drivers on a locomotive produce the very high bending stresses from dynamic augment. Because in a 100-car train there are 400 more car wheels on the rails than there are main drivers of a locomotive, attention is automatically focused on the damage to the rail head from freight car wheels. Peak shock stresses received from freight car wheels cause serious damage to the rail head below its running surface.

The small, continuous wave action produced in the rail by the bending moments from innumerable car wheels will cause the destroyed fibres in the rail head to develop by detail fracture into a transverse fissure.

[625 .172 (.73) & 625 .245 (.73)]

Atchison, Topeka & Santa Fe Railroad track inspection car has interesting features.

Figs. 1 to 9, pp. 1047 to 1050

(*Railway Engineering and Maintenance.*)

The Atchison, Topeka & Santa Fe Railroad, after an extended period of study and development, has recently completed and placed in service a track inspection car which records various characteristics of the track graphically. The record is made on a single roll of paper and shows the low joints on each rail, together with the amount that each is low; variations of gage; the lateral movement of the truck and car body with respect to the gage side of the right hand rail; the cross level of the track and the inclination of the car body; the speed of the car and the location of landmarks which are noted as they are passed and from which the other data may be located on the ground. All of this information is recorded by pens as the paper passes over a platen or table and in addition to the graphical record the total number of low joints of each class is recorded by counters. The mechanism is mounted in a business car with an observation platform, which affords opportunity for visual inspection as the records are being made, and has demonstrated accuracy at high speeds, thus permitting its use on any train on which observation cars are not run and allowing a large mileage to be covered in a short time.

The studies which resulted in the mechanism in its present form were begun in 1914 but due to the interruption caused by the war they were not completed until 1925, the car being placed in service in the fall of that year. A description of the car, prepared by J. de N. Macomb, then office engineer in the office of the chief engineer of the Santa Fe system, and E. E. Chapman, engineer of tests of the same road, was presented as a supplement to the report of the Committee on Rail at the American Railway Engineering Association convention last March, and a brief description was pub-

lished in the daily edition of the *Railway Age* and *Railway Engineering and Maintenance* of 9 March. Since that time minor changes have been made in some of the mechanism as a result of the experience gained from the operation of the car.

The record paper is ruled with straight lines to indicate the zero scale for each characteristic, the lines being spaced 3/8 inch apart to furnish a scale by which the variations in track level and the inclination of the car body may be measured. The paper is driven by means of a belt from an axle of the rear truck and by the use of a flexible shaft and a set of reduction gears it is moved over the table in the direction the train is running, at the rate of 13.2 inches per mile of track, regardless of the speed of the train. This corresponds to a scale of 400 feet to the inch, which is also the scale of standard profile paper, permitting ready comparison with profiles or alinement plats.

The graphical record.

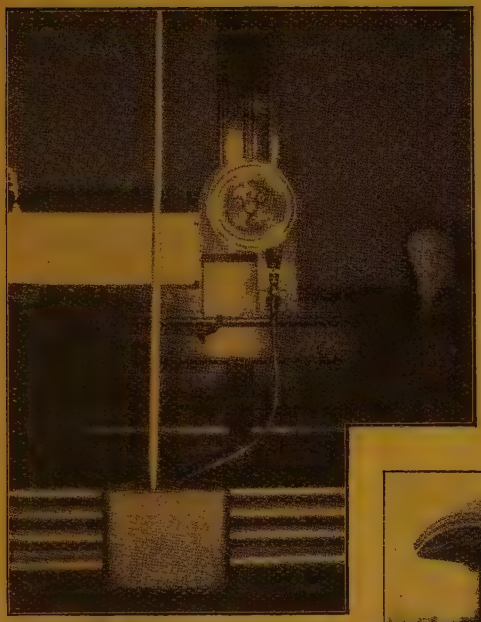
Beginning at the bottom of the paper as it passes over the table the first record is a continuous line showing the inclination of the car body, or the « car tilt » as it is designated on the record sheet. This record is one of angular measurement, each 3/8 inch interval between the horizontal lines representing two degrees of inclination. Since a difference of one inch in the elevation of the rails of the track corresponds to an inclination of approximately one degree, a record showing a car tilt in degrees equal to the difference in elevation of the rails in inches indicates that the track level and the car body are parallel. This record is particularly valuable in studying the effects of curve superelevation at various speeds.

Immediately above the car tilt record is that of the cross level of the track, which shows deviations from level on a scale of 3/8 inch to the inch. When this record falls below the base line it indicates that the right hand rail is low, while in case the left hand rail is low the record will appear above the base line. This information is valuable not only to indicate the cross level of tangent track but also to show the amount and regularity of the superelevation of curves, spirals and runoffs.

Speed is scaled from marks at 10-second intervals.

Next is a line showing time intervals, distance and location. This line is straight except for short offsets below the line which occur at 10-second intervals and which permit the speed at any point to be ascertained by a scale so graduated that the speed is shown by the various lengths between the 10-second intervals, the pen being controlled electrically by a clock mounted in the rear of the car. The locations of landmarks, such as mile posts, bridges, stations, etc., are shown by sidewise marks above the time and distance line by the same pen which records the time intervals and which is actuated by a switch operated by an observer on the car platform, who at the same time informs the attendant at the table the nature of the landmark, both men being equipped with telephone head sets.

Variations of gage are shown to full scale, wide gage being shown above, and narrow gage below the base line. The gage is checked at frequent intervals, where train stops permit, by the observer who uses a master gage for this purpose. Where variations are found to exist between the record and the actual measurement a note is made of the amount and the location where the check was made, the pen being adjusted at the same time. In this way the gage record is kept within reasonable limits, since variations of more than 1/16 inch between the record and the measurements are rarely found.



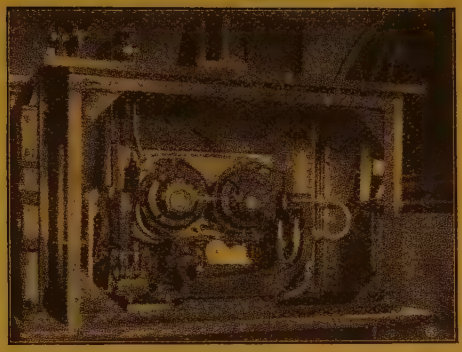


Fig. 3. — Close-up view of the gyroscope.

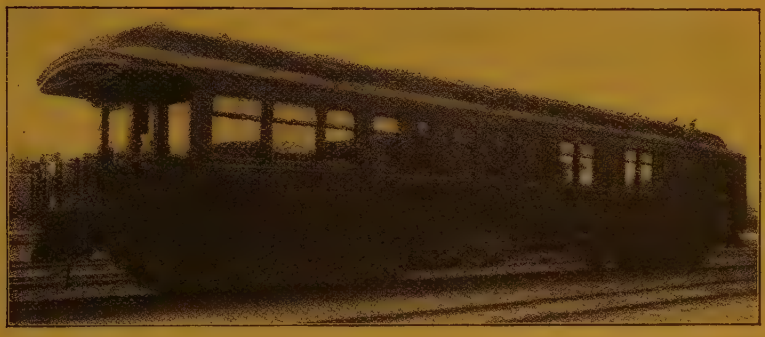


Fig. 2. — The Santa Fe track inspection car.

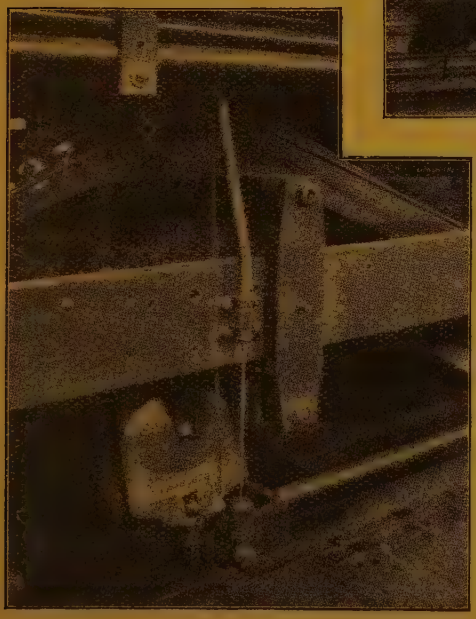


Fig. 1. — Low joints are recorded by an attachement from the truck (shown in lower view) to contact plates inside the car.

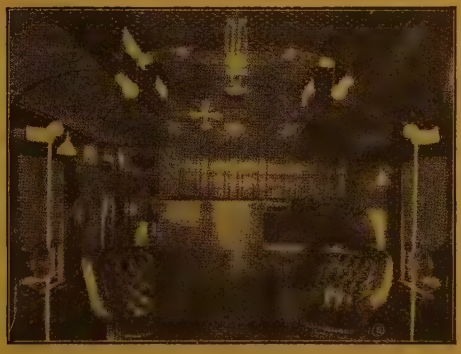


Fig. 4. — The cross beam for recording the cross level of the track is suspended near the roof of the car.

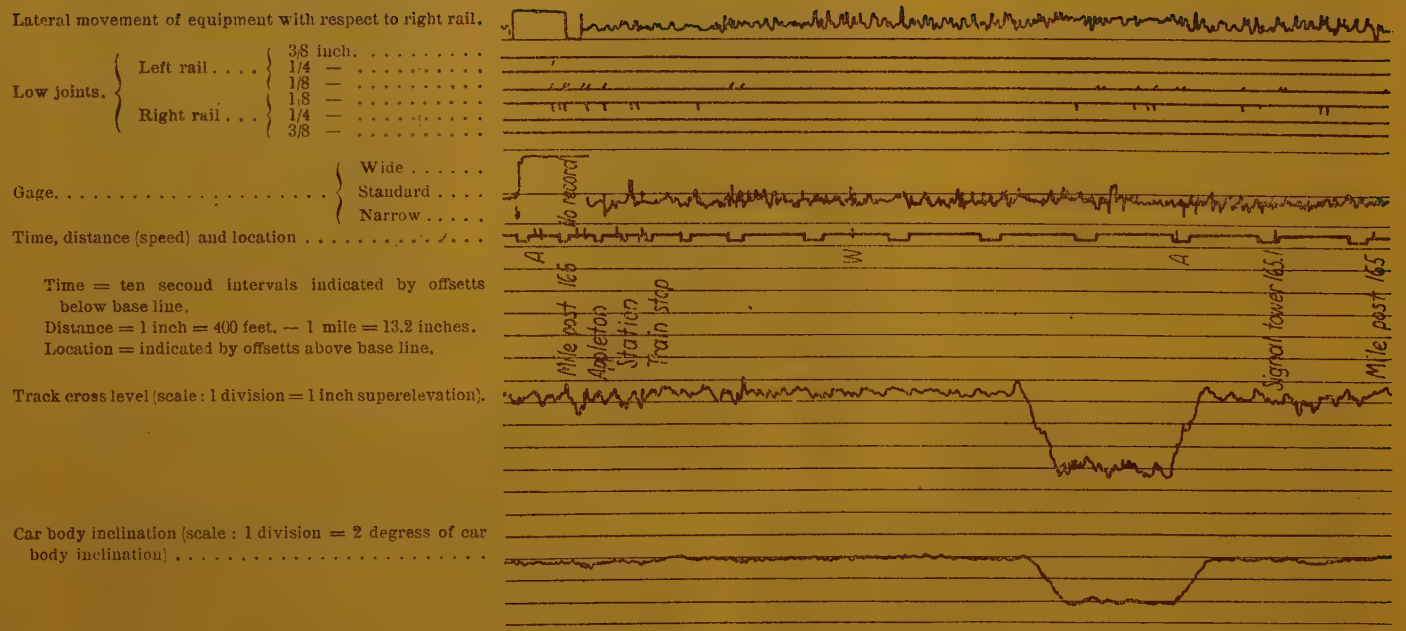

Lateral movement of equipment with respect to right rail.
Low joints.
Left rail . . . .
Right rail . . .
3/8 inch. . . . . .
1/4 — . . . . . .
1/8 — . . . . . .
1/8 — . . . . . .
1/4 — . . . . . .
3/8 — . . . . . .
Gage. . . . . .
Wide . . . . . .
Standard . . . .
Narrow . . . . .
Time, distance (speed) and location . . . . . .
Time = ten second intervals indicated by offsetts below base line.
Distance = 1 inch = 400 feet. — 1 mile = 13.2 inches.
Location = indicated by offsetts above base line.
Track cross level (scale : 1 division = 1 inch superelevation).
Car body inclination (scale : 1 division = 2 degress of car body inclination) . . . . . .
No record
Mile post 165
Appleton
Station
Train stop
Signal tower 165.1
Mile post 165

Fig. 5. — A section of a typical record sheet.

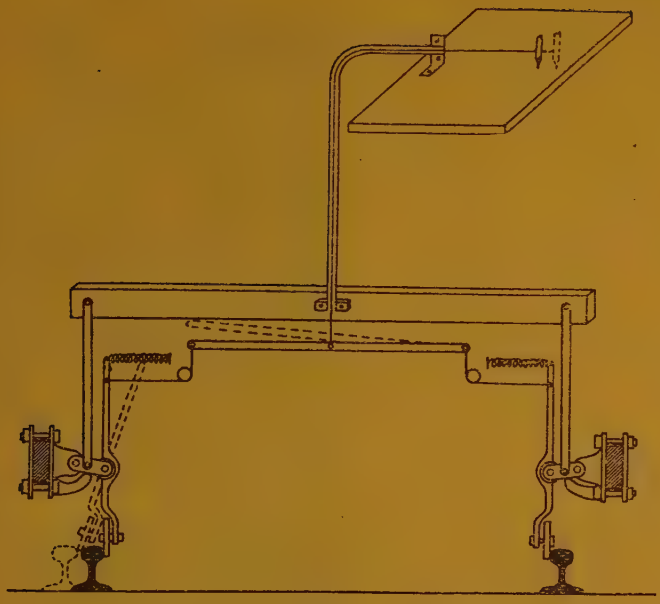


Fig. 6. — Diagram of gage recording mechanism.

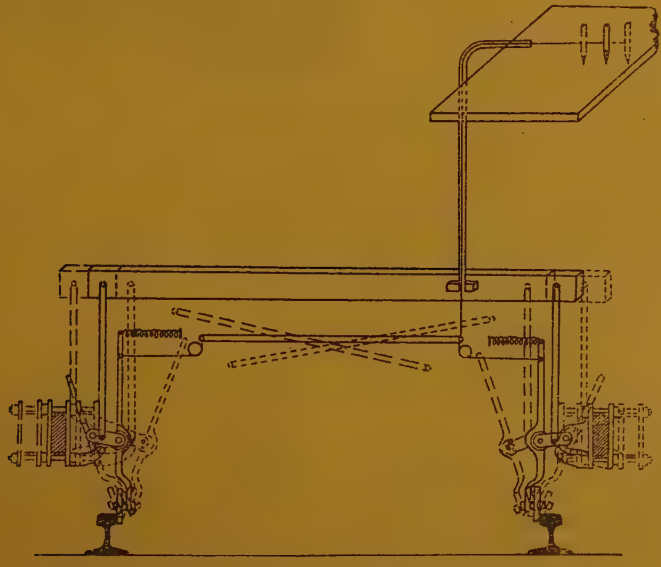


Fig. 7. — Diagram of lateral movement recording mechanism.

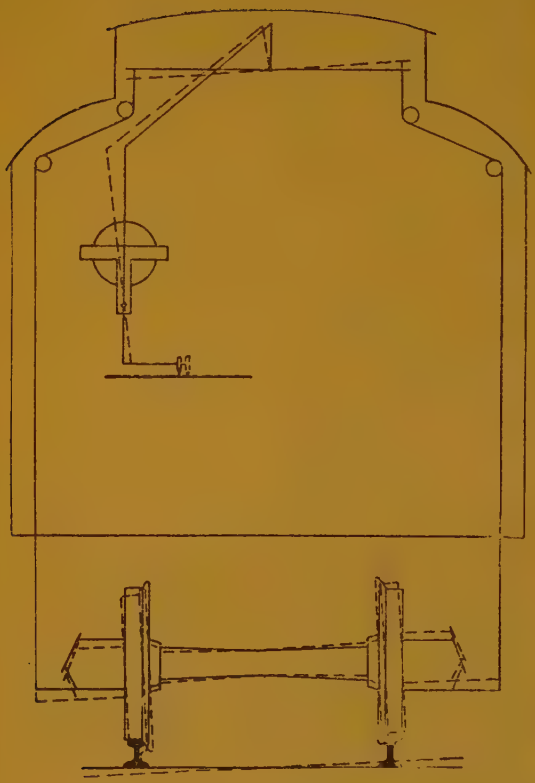


Fig. 8.
Diagram of cross level recording mechanism.

Fig. 9.
Interior of car, showing recording table with gyroscope above.

Low joints are shown by sidewise marks on one of three horizontal lines for each rail, these lines for important high speed tracks representing joints 1/8 inch, 1/4 inch and 3/8 inch low, respectively, while on less important tracks, the mechanism may be set to show joints 1/4 inch, 1/2 inch and 3/4 inch low, respectively.

The top line on the paper shows the lateral movement of the truck with respect to the gage line of the right hand rail of the track, the record being shown a 7/12 of the natural scale. This lateral movement usually cannot be attributed to any one defect in the track but is rather the resultant of low joints and variations in gage, cross level and alinement. It is, however, of value as an index of the general condition of the track.

How the records are obtained.

Without attempting to give a detailed technical description of the mechanism by which these records are obtained, a brief description will be of interest. The low joint device is mounted on a six-wheel truck at the rear of the car, the front and rear journal boxes on each side being connected by rigid bars, while the

center axle is free to move vertically with respect to the bars. As either center wheel drops below the common level of the end wheels the amount of the depression is recorded by means of a cable attached to the journal box of that wheel. The cable passes up through the floor of the car to a wheel which actuates a lever arm carrying contact rollers running on a circular steel race on which contact plates are so arranged that the amount of the depression of the joint is shown on the appropriate line on the paper by an electrically controlled pen, a spiral spring back of the wheel keeping the cable in tension. The current from each contact plate also actuates mechanical counters which give a cumulative record for each rail over any desired length of track.

Track gage and lateral movement.

A continuous record of the gage of the track is made by two wheels six inches in diameter which are held outward against the gage sides of the heads of the two rails by levers to which spring tension is applied, causing the wheels to follow the rails regardless of the variation of gage within any practicable limits. The movements of the levers due to variations of gage are carried to an equalizer bar, which eliminates from the final record all movements except the actual differences in gage. The movement of the recording pen is controlled by a steel wire which passes from the equalizer bar to the frame which holds the pen and makes a full scale record of the deviations.

When the gage-recording device is not in service the wheels and levers on which they are carried may be raised clear of the rails by releasing the air in a special piston which carries the frame supporting the equalizer bar. Trouble is seldom experienced with the gage wheels when passing frogs at a speed greater than approximately 10 miles an hour but it is customary to raise them before passing over facing point turnouts, notice of the approach being given by the observer on the rear platform. Levers are provided at the record table for raising and lowering the wheels, a small air cylinder on each side holding the wheels clear of the rails until they have been lowered into place. The wheels are made of special heat-treated steel mounted on roller bearings and cover a large mileage before it is necessary to renew them.

A record of the side movement of the car between the rails with respect to the right hand rail is also made by the track gage mechanism. Since the distance between the gage points of the car wheel flanges is less than that between the rails, the truck may lurch from one side of its normal position to the other, there being sufficient play in the journal boxes to permit this movement. When the truck lurches to the right the gage wheels remain against the rails, the levers carrying them lean to the right, and the equalizer bar is also tilted with the right end lower. When the truck lurches to the left the levers and equalizer bar are inclined in the opposite direction and the movement of the equalizer bar is utilized to transmit the movement to the recording pen by means of a wire connected to its right end, the record on the paper being 7/12 of the natural scale.

Cross level recording mechanism.

The mechanism for recording the cross level of the track was the most difficult to work out satisfactorily. Pendulums as well as « U »-tubes filled with mercury were considered but it was realized that the action of either the pendulum or the liquid in the « U »-tube would depend upon the relation of the speed and the amount of superelevation of the curves and also that the variations in tangent track would so affect these devices that accurate results could not be obtained readily. Hence, efforts, along these lines

were abandoned, and experiments were made with the gyroscope. Before they were brought to a successful conclusion the country entered the World War and further studies were discontinued for the time being.

A few years ago, when the studies were resumed, a consultation was arranged with Elmer A. Sperry, president of the Sperry Gyroscope Company, Brooklyn, N. Y., who had developed the use of the gyroscope for ships' compasses, as stabilizers for ships and airplanes, and also for controlling the fire of guns on ships. Investigations revealed that the forces set up when a train rounds a sharp curve at high speed are greater than those encountered on airplanes or ships, but further experimentation showed that is was possible to use the gyroscope successfully on fast trains.

The gyroscope is enclosed in a glass case supported by a bracket attached to the side of the card. It is of the double rotor type enclosed in cases and supported in a gimbal ring which in turn is supported by a frame, the gimbal ring standing in a vertical plane longitudinal with the car. The rotors revolve in opposite directions in a vertical longitudinal plane at a speed of 12 000 revolutions per minute, the right hand rotor turning clockwise and the other counter clockwise, being connected by gear sectors which require equal movements.

The gyroscope is restrained from moving from its normal position, or is brought back to that position after having been thrown out of vertical by some external force, by an air balancing device which utilizes air from the train line after reducing the pressure to about eight pounds per square inch. The air flows through a divided pipe into two cylinders fitted with pistons and a small pipe leads from each cylinder to separate port valves. Brackets on the rotor cases are so placed that when the gyroscope turns from its normal position, one of the brackets will cover its corresponding port valve, thus setting up a pressure in the cylinder and forcing the piston downward. This movement of the piston opens a valve which permits the air to flow through a nozzle upon a wheel, causing it to turn and to set in motion a train of gears which causes the gyroscope to return to its original position.

The cross level records of both the track and the car body are made by means of a horizontal cross bar suspended near the roof of the car, and connected by cables to each side of the truck. The bar is free to rotate about its center and moves vertically in a guide, spring tension on the bar keeping the cables tight and causing the bar to follow the exact cross level of the track regardless of the swinging or bouncing of the car body. A shaft extends from the center of the cross bar longitudinally near the roof of the car to a point near the recording table and thence the movement is transmitted to the recording pen by a system of shafts, levers, cables and bars. The pen bar for the cross level record is connected with the gyroscope in such a way that the car body effect is eliminated and the final record of the pen shows the difference in level on a scale of 3/8 inch to the inch. Without the corrective influence of the gyroscope the record shown would be the difference in cross level of the track compared with that of the car body.

The control of the gyroscope upon the cross level recording pen is effected by a lever extending from the left upper corner of the gimbal ring upward through the top of the glass case. To the left of this lever is a parallel lever connected to the car inclination pen bar and the cross lever pen bar. For these pen bars to function properly it is essential that the latter lever follow exactly that of the former. Since it is undesirable to attach these levers directly to the gyroscope their movement is controlled electrically.

Owing to the change of direction on curves the gyroscope will sometimes deviate, producing a trend somewhat out of parallel with the ruled lines on the paper. When this occurs it is easily recognized on the record and the average line is drawn in.

During the present year the car has taken records on approximately 15 000 miles of track, completing this mileage shortly after the middle of June. It is the intention to take records in the spring and fall of each year so that a comparison of the records may show to what extent track conditions have been improved by the season's work. The records are particularly useful in that they are taken under load and often reveal defects which would not be discovered by the use of the trackman's ordinary instruments. They are also useful for comparing various sections or divisions with one another or to determine the relative merits of different track materials, such as rail or ballast, as evidenced by their behavior under load.

Blue print copies of the record are sent to the general and division officers and every effort is made to familiarize the division engineers and roadmasters with them so that they may be used as a basis for programming their work. To this end the division engineers and roadmasters are encouraged to accompany the car while it is on their respective territories so that they may observe the track as the records are being taken and obtain at first hand any information concerning them that they may desire. Arrangements are also made whereby blue prints of the records for individual sections may be obained by the section foremen, for while some foremen can locate defects with little effort others are not always able to do so and in such cases the record is a distinct aid in showing where the track is most urgently in need of attention. When the records are sent out a sample record containing instructions is also sent as an aid to their use.

In order to ascertain the value of the records a test was made on one district by furnishing the foremen on half the sections with records taken on their track, while they were not furnished to the foremen of the remaining sections. Later records taken over the same district showed that the foremen supplied with the records made the most improvement in their track with a material saving in labor over the sections which had worked without the records, and indicated that considerable economies will result from the use of the records, aside from the improvement in the character of the work.

Statistics from the records may be assembled in tabular form for any desired length of track, showing for each mile the number of low joints, classified by the amount each is low; the number of points where the gage is wide and the number of places where the track is out of level, classified for appropriate amounts. Such a tabulation taken from an actual record is shown for 25 miles of main line track.

While it is the practice to operate the car only during daylight hours it has been operated at night where delays would otherwise disarrange the schedule for its movement which is made out in advance of its assignment to any given territory. When night operation is necessary electric spotlights are used to assist the observer on the rear platform to pick up and identify the landmarks along the track.

The car carries an operating force of three men, one being in charge, with two assistants. The attendant at the record table and the observer alternate in their duties, not only to relieve the monotony but also that they may become familiar with all phases of the work and to avoid delays in cases of emergency. Living quarters are provided on the car, with an attendant who prepares the meals and takes care of the car. When a meal is

served while records are being taken the various members of the force are relieved one at a time so that no interruption occurs.

MILES.	Low joints.	Both rails.		Gage.		Cross level.		
	1/8-inch.	1/4 inch.	3/8-inch.	Gage kinks at joints, number.	Gage over 1/4-inch wide, number of spots.	1/4-inch or more out of level, number of spots.	1/2-inch or more out of level, number of spots.	3/4-inch or more out of level, number of spots.
557-558	0	0	0	16	0	22	3	0
558-559	1	1	0	27	2	25	3	0
559-560	4	1	0	19	5	31	7	1
560-561	0	0	0	10	0	29	0	0
561-562	9	0	0	21	0	29	0	0
562-563	6	0	0	33	1	28	0	0
563-564	3	0	0	24	0	26	0	0
564-565	4	0	0	16	0	34	0	0
565-566	12	4	2	16	3	31	4	0
566-567	2	0	0	6	0	18	0	0
567-568	0	0	0	9	0	13	0	0
568-569	3	0	0	17	0	31	0	0
569-570	0	0	0	23	0	20	0	0
570-571	4	2	0	31	2	38	0	0
571-572	7	0	2	42	3	39	0	0
572-573	5	0	0	36	1	54	0	0
573-574	3	2	0	41	2	29	0	0
574-575	9	1	0	30	2	32	0	0
575-576	3	0	0	19	0	5	0	0
576-577	5	1	0	21	1	3	0	0
577-578	6	1	0	35	0	4	0	0
578-579	10	1	0	24	1	15	1	0
579-580	11	1	0	24	0	9	0	0
580-581	12	1	0	51	2	14	0	0
581-582	7	2	0	41	3	14	0	0
Total. . .	126	18	4	632	28	593	18	1
Average per mile.	5.0	0.7	0.16	25.3	1.1	23.7	0.7	0.04

The mechanism is inspected carefully at the end of each day's work and all ordinary repairs and adjustments are made at that time, a sufficient supply of spare parts being carried so that no delays occur except in the case of major acci-

dents. Electric current is supplied from a large storage battery charged by an axle-driven generator.

The car was developed by C. F. W. Felt, chief engineer of the Santa Fe System, assisted by J. de N. Macomb, then office engineer in Mr. Felt's office, and by E. E. Chapman, engineer of tests. As has been said above the adaptation of the gyroscope to the car was worked out by Mr. Sperry, who also devised the cross level bar as well as the recording table. L. F. Carter, Mr. Sperry's assistant, supervised the installation of these devices, and Paul W. Steelsmith, of the Santa Fe's test department, who is in charge of operation of the car, participated in its design and construction and also worked out the changes which have been made in the mechanism since the car was placed in service. T. A. Blair, formerly assistant engineer in the engineering department who was later a roadmaster and is now division engineer of the Panhandle & Santa Fe, a subsidiary of the Santa Fe, did much work in developing the uses of the records in connection with track maintenance.

[624 .8 (.73)]

Atchison, Topeka & Santa Fe Railroad builds new bridge over Mississippi River.

Figs. 1 to 7, pp. 1056 to 1062.

(From the *Railway Age.*)

The longest and heaviest swing span ever built is the principal feature of a new bridge across the Mississippi river, now being completed by the Atchison, Topeka & Santa Fe at Ft. Madison, Iowa. While the primary purpose of the new bridge is to replace an old structure completed in 1887, which was no longer of adequate load-carrying capacity, it has the further advantage of providing double tracks, thereby eliminating a stretch of single track introduced in the line by the old crossing. Furthermore, the new bridge has been placed on a new location which permits of much better grade and alinement of the approaches than was possible in the location of the old structure.

The problem of a satisfactory location for the crossing was a difficult one and was given extensive study before a definite position for the new bridge was determined. On the Illinois side the line of the Santa Fe lies upstream from the crossing in a position parallel to the river, while on the Iowa side the railroad lies close to the river bank for a considerable distance down-stream. To secure the shortest length of bridge, the old crossing was placed at right angles to the river channel, introducing curves of about 90° central angle in the alinement of each approach, and owing to the close proximity of the west bank of the river and the river channel, it was necessary to place the west approach on a 10° curve. To avoid this objectionable condition in the new bridge, it was placed in a location up-stream from the old structure on a skew of 65° with the direction of the channel, thereby reducing the total curvature by about 50° of central angle and reducing the rate of curvature in the west approach to 5°. This change in lo-

Fig. 1. — The river spans of the Fort Madison bridge and the east approach.

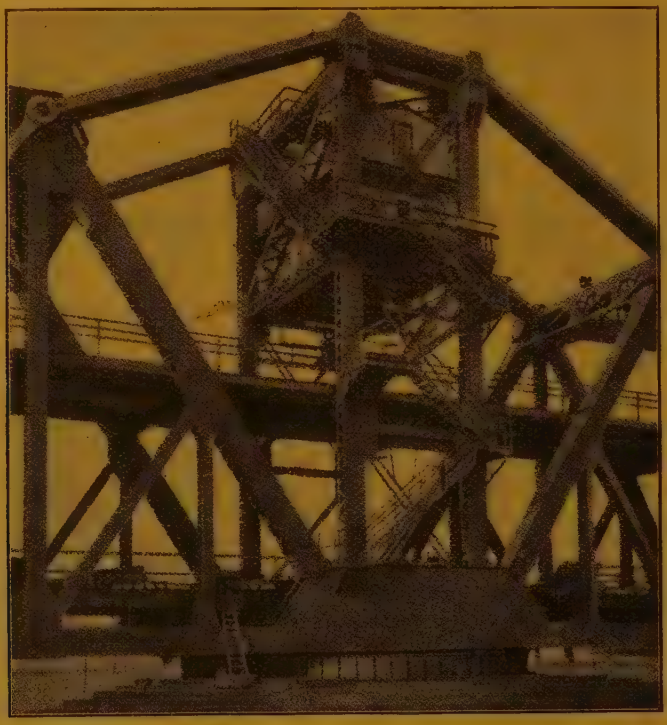


Fig. 2. — View of the drum and tower of the draw span showing how the tower posts and main diagonals are framed into the bottom chord.

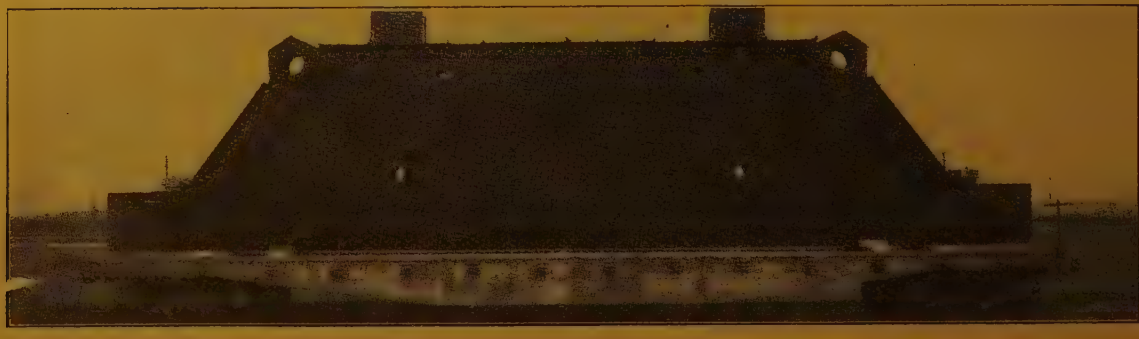


Fig. 3. — One of the two center sections of the draw span bottom chord, 40 ft. 11 1/2 in. center to center of splices, weight 61 t

cation had the further advantage of obviating any interference between the construction work and the existing bridge.

Swing span on a skew.

The main river crossing consists, from east to west, of four fixed through truss spans of 270 1/2 feet and a draw span with two equal arms of 265 ft. 10 in., the distance being measured center to center of piers. All piers are set square with the center line of the bridge with the exception of the two rest piers for the draw span which conform to the skew of the channel. The east approach consists of nine spans of girders 100 ft. 6 in. center to center of piers and the west approach of nine spans of girders 80 ft. 6 in. and one span 102 ft. 4 in. center to center of piers.

The Mississippi river at F. Madison lies within the limits of slack water above the Keokuk power dam which is located about 23 miles downstream from the Santa Fe crossing.

Consequently, low water level is now about 10 feet higher than it was before the dam was built, thereby reducing the headroom between low water and the superstructure of the old bridge. However, to avoid increasing the grade on the approaches and to economize in the substructure masonry, it was desirable to keep the track grade on the new bridge as low as possible, and the plans approved by the United States War Department provide for a clearance of 10 feet over the high water level guaranteed by the water power company. This arrangement made it possible to restrict the grade on the approaches to 0.4 %. It also gives the bridge an appearance of being set unusually low over the water, an effect that is emphasized by the depth of the trusses in proportion to their length which is greater than usual for reasons that are explained later.

Another consideration affecting the design of the bridge was the necessity for providing a roadway for highway traffic. In the old bridge there is a roadway on each side of the railway deck carried on brackets outside of the trusses. This arrangement was unsatisfactory for several reasons and was abandoned in the new bridge in favor of an upper deck for the highway traffic. But to avoid excessive grades and long run-offs on the highway approaches, this upper deck was not placed at the level of the top chords but was installed instead at an intermediate level that affords adequate vertical headroom over the railway deck. The depth of the trusses was therefore determined by the necessary headroom between the highway deck and the portal bracing, a condition which pointed to the greater economy of trusses having parallel chords.

Bridge serves as overcrossing for highway.

To allow for the descent of the highway from the level of the deck inside of the trusses the approach viaducts are offset beyond the ends of the truss spans to a position alongside the railroad approaches. The highway east of the bridge is on the south side of the track while west of the bridge it is on the north side, so by placing the east approach south of the railroad approach and the west approach north of the railroad, the bridge serves as an overcrossing that eliminates a crossing at grade. The trusses are of the Pratt type with subdivided panels ranging from 19 feet to 20 ft. 6 1/2 in. in length, except for the two panels on each end of the swing span and at the skewed end of the adjoining truss span which are 15 ft. 6 1/2 in. long, that is, the distance by which the bearings for one truss are in advance of those for the other over the skewed piers. The trusses are 33 ft. 4 in. center to center, affording a clear width of 30 feet. The distance between the center lines of bottom and top chords is 58 feet or sufficient to pro-

vide a headroom of 16 feet over the highway deck and a vertical distance of 22 ft. 7 in. from face of rail of the railroad deck to the underside of the highway deck or sufficient to give a clear headroom of 22 feet above the top of a 130-lb. rail on a heavy tie plate.

Stiff members with riveted connections are used for all parts of the trusses except for the intermediate panels of the bottom chord of the fixed spans which are made up of 12-inch by 2-inch eye-bars, and for eye-bar connections between the top of the tower over the pivot pier and the two halves of the swing span which are 16 inches by 1 7/8 inches. Pin connections are also used in the draw spans where the main diagonals connect to the bottom chord members over the pivot pier and in the longitudinal tower bracing.

The railroad portion of the approaches consists of deck girder spans, while the highway portion consists of through girder spans supported on steel bents carried on extensions of the piers which support the railroad approaches. The east highway viaduct has a grade of 4.27 % and that on the west a grade of 4.95 %. These viaducts are stayed against longitudinal distortion by solid web knee-braces at the junction of the columns with the girders and by tower bracing with one span of each approach.

Provide ballast floor.

With the exception of the swing span, the entire railroad deck has a creosoted timber ballast floor. On the fixed truss spans this consists of 4-inch by 10-inch planks supported on a stringer system consisting of four main stringers under each track with a jack stringer between the tracks and between each track and the adjacent truss. Continuity of the deck at the ends of panels is carried out by enclosing the top flanges of the floor beams (which project above the stringers) with a bed of bituminous putty that completely fills the channel shaped space between adjoining timbers above the tops of the stringers.

The highway deck is of reinforced concrete topped with a 3/4-inch thickness of John-Manville's standard asphalt bridge road surfacer. The concrete slab is supported on steel stringers, of which four are of a special built-up box section designed to support rails for two street car tracks depressed in the pavement, while one on the center line of the bridge and three next to each truss are of 15-inch I-beams.

The floor beams and stringers of the upper deck are protected by smoke shields 36 inches wide centered over each track. These are made of 3/8-inch steel plates curved concave downward for

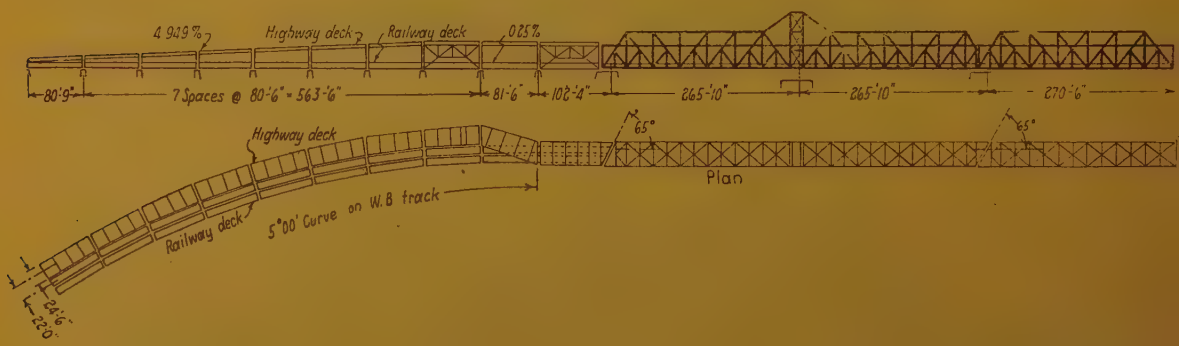


Fig. 4. — Plan and elevation of the

ready drainage. Bolted connections of the plates to the floor are designed to facilitate ready renewal.

Swing span imposes heavy reactions.

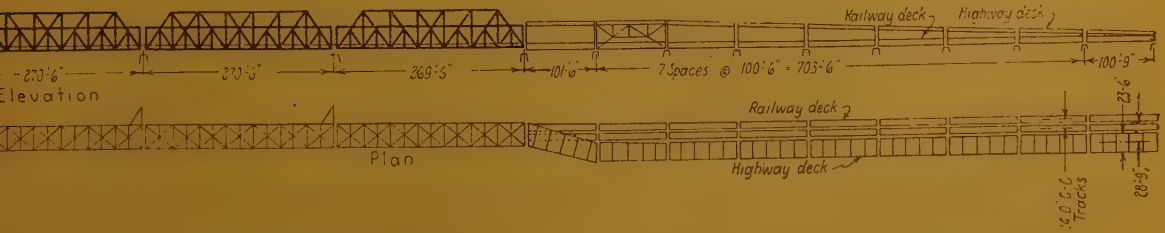
Developments of a practical design for a swing span of the length and weight imposed in the Ft. Madison structure presented conditions not encountered in bridges of ordinary proportions and necessarily involve departures from usual practice. Investigation of a center bearing design for a swinging reaction of 10 000 000 lb. and a closed reaction of 15 000 000 lb. on the center pier developed prohibitive proportions and led to the adoption of a combination center and rim bearing design in which one-third of the load is carried on the center and two-thirds on the drum. The practical evolution of this idea, under the conditions imposed in this case, gave rise to a method of load distribution which not only possesses a commendable simplicity but also embodies some unique details.

The load distribution system consists of eight loading girders spanning transversely between the two trusses and 16 radial girders which, at their outer ends, frame into a drum girder 42 feet in diameter, and at their inner ends rest on top of a disc-type center bearing. The primary problem involved was to distribute the load from the trusses to the loading girders and from the loading girders to the radial girders so that each radial girder would receive 1/16 of the total load, with the further requirement that the point of application of this load would be such that one-third would be carried to the center and the remaining two-thirds would be carried to the drum.

One of the photographs (fig. 3) shows a view of the center or tower section of one of the bottom chords loaded on a flat car for shipment. It has more the appearance of a girder than a chord member because of the deep gusset construction provided for the two bottom chord tower panel points. Splice plates for the tower post connections, and pin plates for the main diagonal connections are seen at the top. These gussets, therefore, have an important function in the distribution of stress between these two members and the bottom chords. They also provide the necessary stiffness for the distribution of the weight of the span to the loading girders which frame into the chord in pairs symmetrical about the two panel points.

An articulated loading system.

Another distinctive feature of the design is the manner in which the load is transferred from the loading girders to the radial girders. The radial girders are connected in pairs at a point 14 ft.



alf of the Madison bridge.

4 in. from the center or approximately the outer third point by steel loading or diaphragm castings which frame into the webs of the adjoining girders and on top of each of these castings is a bearing casting having a spherical top surface of 1 ft. 5 3/4 in. radius. Also, at two points in the length of each pair of loading girders, so located as to come directly over the eight bearing castings mentioned above, the loading girders are connected by similar diaphragm or loading castings with a concave spherical surface at the bottom with a 1-ft. 6-in. radius that fits over the top of the bearing castings below. Thus the load of the span is transmitted to the drum frame through eight articulated points of bearing.

The center construction is of large proportions. It has a cast steel base 10 feet in diameter which supports a hard tool steel disc 4 feet in diameter, the top face of which has a concave spherical surface with a radius of 13 ft. 9 in. On top of this is a phosphor bronze disc of the same diameter, with a convex spherical surface on a radius of 13 ft. 4 1/4 in., and this disc in turn supports the top or loading casting of cast steel upon which the inner ends of the radial girders are supported. The sliding ring with a phosphor bronze bushing is connected by means of eight spiders to the live ring under the drum which contains 72 cast steel wheels having a mean diameter of 1 ft. 8 in. and a tread width of 1 ft. 1/2 in. running between upper and lower treads of cast steel built-in segments.

Heavy turning machinery.

The turning machinery is distinctive in that the four driving pinions are in no way connected with each other by equalizers. Each pinion has an individual set of reducing gears and is driven by four independent motors. Each is a General Electric 75 H. P., 440-volt, 3-phase, 25-cycle, mill type motor and is equipped with a solenoid brake. These motors have a normal speed of 475 revolutions per minute with a starting torque of 1 900 foot-pounds, a normal torque of 788 foot-pounds, and a maximum torque of 2 500 foot-pounds, that can be sustained for one hour without injury to the motor. These characteristics of these motors being the same and the electric current being supplied to all from the same power line, they themselves equalize the load so that the force required at the rack is equally distributed between the four. The main driving pinions have a 28.648- inch pitch diameter, are mounted on a 14-inch diameter shaft and mesh with a cast steel rack having a pitch diameter of 45 ft. 10 1/32 in.

All of the turning machinery is located beneath the railway floor and on top of the drum and radial girders and is operated by remote control located in the operating house in the tower of the swing span above the highway floor.

The end lift and bridge lock at each end of the span is operated by two 50 H. P. General Electric, 440-volt motors operated at 475 revolutions per minute; one motor normally driving the machinery, the other drifting, but so arranged in the control that either of the motors may be made operative by means of a double-throw switch. The solenoid brakes on these motors are so arranged that both will be operative regardless of which motor is working.

The end lift is of the eccentric swinging rocker type, while the latch is of the positive plunger type. Because the ends of the span are skewed the span must always be opened one way and cannot be allowed to swing by the closing position. Consequently, the balanced or automatic closing type of lock had to be discarded in favor of a lock that would not only be closed by a power drive but which would be strong enough and be driven by ample power to force the span into proper alinement in spite of lateral warping resulting from differences in temperature of the two sides of the span. The plunger of the latch is 5 inches by

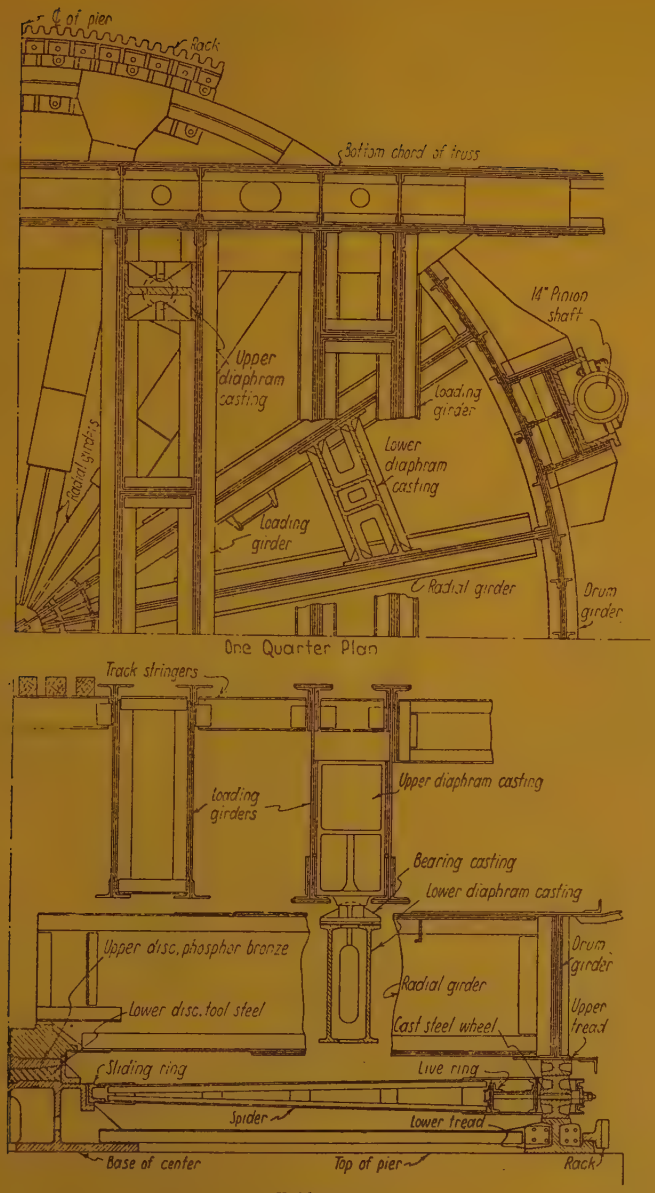
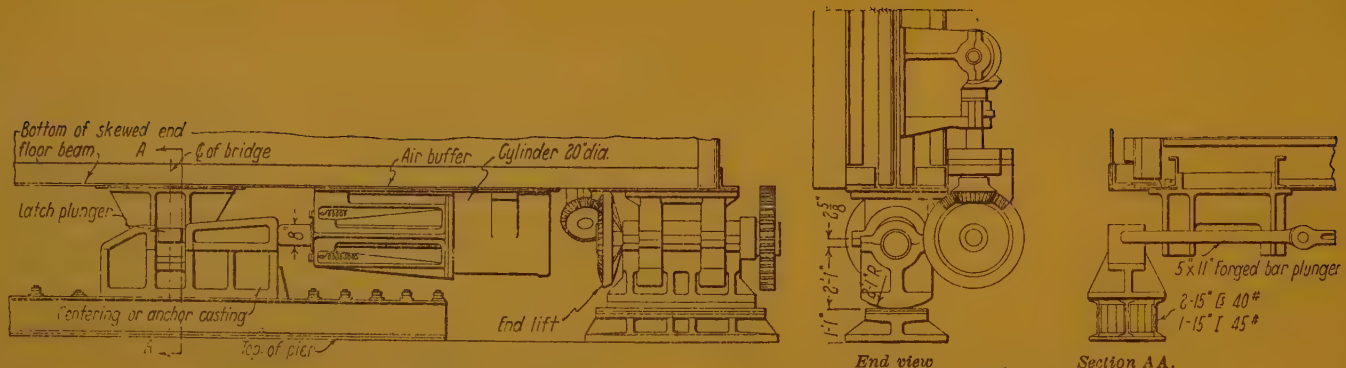


Fig. 5. — Sketch plan and section of the load distributing construction over the pivot pier.

11 inches in section and is bevelled on its vertical sides so that it can be forced into the seat provided for it in a centering casting securely bolted to the bridge seat.

This anchor casting serves the further



Elevation of bridge lock and one of the end lifts.

End view of end lift.

Section A A.

Fig. 6. — The end lift and bridge lock.

Fig. 7. — A view of the west approach with the west end of the old bridge at the left. One of the highway traffic barriers is shown in the foreground

purpose of an abutment to receive the impact of the plunger of an air buffer attached to the end of the span for the purpose of insuring against over-run of the span when closing. It consists of a cylinder 20 inches in diameter by 3 feet long, provided with a piston having a piston rod 8 inches in diameter that comes in contact with a vertical face on the end of the anchor casting. This air buffer is designed to develop a pressure of 31.6 lb. per square inch of piston surface or a force of approximately 10 000 lb. when the span has reached the closed position.

The rail locks are of the MacDonald easer rail type operated by a five-horsepower General Electric motor at each end of the bridge. Another feature of the swing span design worthy of mention is the provision made for the exact balance of each truss over the center pier in spite of the lack of symmetry resulting from the skew end construction. The short end of each truss is provided with a counterweight of 57 500 lb., composed of cast iron blocks placed on the bottom chord in the end panel.

To protect highway traffic when the bridge is open, a vertical lift gate or barrier has been provided on the highway deck in the flanking spans. These barriers consist of structural steel trusses spanning transversely between vertical guides and are suspended by chains which pass over sprocket wheels to counterweights, the travel of the gates being made positive by means of a direct motor drive to the sprocket wheels.

How the span is operated.

Complete reversing magnetic controls with master switches are provided for the swing motion and end lifts, while the motors on the rail locks and barriers are controlled by means of push buttons through reversing magnetic switches. A switchboard panel with oil circuit breaker, voltmeter, ammeter and watt-hour meter is furnished for the main circuit.

Complete limit and interlocking protection is provided through the medium of track-type switches. Indicator lights show the various positions of the span during the swing and the extreme positions of the end lifts and rail locks. There is an electrically operated siren for signaling approaching vessels.

The operation of opening the draw span is accomplished in the following sequence :

Interlocking plant signals are placed in the stop position and derails are opened, permitting the bridge lock lever to be reversed and energizing a master control relay. This latter operation, together with the closing of the highway traffic barriers, completes a circuit which permits the first operation in opening the draw, that is, the raising of the bridge rail locks. When the rail locks are clear, as indicated by signal lights, a circuit is closed which permits the end lifts to be lowered, and when the lights show these in proper position a contact is closed, making power available for the swing movement.

As the bridge swings open the « span closed » indicator light is extinguished and light indications are shown in turn for « span nearly closed », « span nearly open » and « span open ». When the « nearly open » position is reached the power is automatically cut off and brakes are set, after which the operator can continue the movement to the fully open position by stepping on a foot-operated push button which provides only limited power, an additional limit switch cutting off power entirely at the « fully open » position.

In closing the span the same sequence of operations is performed in the reverse order, it being impossible to clear the signals for railroad traffic until the bridge is closed and locked.

Substructure entirely of concrete.

Exploration of the river bed on the site of the new bridge with the aid of core drills showed that bed rock lies at an elevation 165 feet below low water level and is over-laid with a thick stratum of sand, gravel and clay that possesses a considerable sustaining power. There was, therefore, no occasion for carrying the pier footings to rock, even if there had been any practicable plan for carrying the foundations to so great a depth. The river piers were accordingly founded on the over-burden at a depth of 62 to 72 feet below low water while the piers for the approach spans are on pile foundations.

All of the piers are of concrete, with shafts having side and downstream end batters of 1 inch to the foot and a batter of 2 inches on the upstream end, except that the shaft of the pivot pier is a true cylinder. All of the piers are devoid of copings, belt courses, rustications or other embellishments. They are provided with reinforcement to resist temperature stresses consisting of grids of 3/4-inch bars spaced 18 inches center to center, both vertically and horizontally at a depth of 6 inches from all faces except under each bearing shoe where the spacing is 9 inches. The shafts are dowled to the footings by 5-foot lengths of 75-lb. and 85-lb. rail, spaced 2 feet center to center, both longitudinally and transversely. The intermediate piers under the fixed spans have shafts 10 ft. 6 in. wide by 42 ft. 4 in. long and have caissons 22 feet wide by 68 feet long. The pivot pier is 47 feet in diameter with a caisson 52 feet square.

The caissons for the river piers were entirely of timber construction and were built clear of the water by suspending them from 4-inch diameter screws supported from a dock constructed for that purpose. They were readily launched by turning down the screws and were floated in an upright position to the pier site. No particular difficulty attended the sinking of the caissons, position and alinement being readily maintained. Tests of the foundation material by means of jacks developed values for bearing power at least four times that used in the design of the piers, which were proportioned on the basis of four tons per square foot after making allowances for skin friction on the sides of the caissons.

Approach piers are long.

As the piers for the approaches served as supports for independent railroad and highway superstructures located side by side, they are much longer than the river piers, the maximum length being 78 feet and as there is a considerable difference in the loads imposed, the pier shafts are tapered at mid-length from a width of 6 ft. 6 in. for the railroad portion to 4 feet for the highway portion.

These piers are all supported on pile foundations at depths ranging from 12 feet to 38 feet below high water. It was, in consequence, necessary to provide cofferdams of substantial construction. These were built of 6-inch by 18-inch timbers laid edgewise and were braced and calked while constructed in a floating position. When completed they were towed into location over the pier site which had been previously excavated with a clam shell bucket to an average depth of 1 1/2 feet. After the cofferdams had been sunk between dock piles the foundation piles were driven and the bottoms were sealed with from 4 feet to 7 1/2 feet of concrete, following which the interior was unwatered to permit the cutting off of the piles and the placing of the remainder of the concrete in the open.

A volume or concrete in the substructure, draw rest and floor of the highway deck totaling 44 500 cubic yards justified an investment in a concrete plant that would make for maximum economy of operation as well as adequate capacity, and special pains were taken to develop

a layout that would entail a minimum of manual effort in both the handling of the materials and the delivery of the concrete to the forms. Careful consideration was also given to the facilities for the control of quality as the concrete was proportioned on the basis of designed strengths of 2 000 lb. per square inch in the footings and caissons, 3 000 lb. in the pier shafts.

Provision for winter work.

With a construction schedule requiring the concrete-work to be continued through the winter, ample provision had to be made for the heating of the materials and for the protection of the concrete in the forms as well as to provide ample storage space for materials to avoid stoppage of the work in the event of failure of deliveries during cold weather. The concrete plant was located at the end of the east approach in the space between the new and old lines where delivery tracks could readily be provided with connections from the operated line and space could be had for the storage of 10 000 cubic yards of stone and 7 000 cubic yards of sand and for the construction of a cement storage building with a capacity of 13 carloads, in close proximity to the mixer plant which was equipped with a Koehring mixer with overhead storage bins for sand and stone. The aggregates were handled from cars into the storage piles or the bins, or from the piles to the bins by a bucket and derrick. The cement was delivered from storage to the mixer in bulk by means of an inclined conveyor and both aggregates and cement were measured in charging hoppers. Water was controlled by a tank with a water gage.

The mixer was placed at a sufficient elevation above the ground so that it could be discharged directly into side dump hopper cars run on a narrow-gage track that extended out on a pile trestle built parallel to and south of the new bridge. These cars were hauled in trains of two by gasoline locomotives. For delivery to any part of the substructure, the hopper cars were dumped into buckets mounted on a barge equipped with a derrick with an 80-foot boom which handled the buckets for discharge into the forms.

All the concrete was proportioned for the desired strength according to the water-cement ratio with consistencies that resulted in slumps of from 1 1/2 to 2 1/2 inches. For sealing the cofferdams better results were obtained with slumps of 4 inches. Test cylinders made throughout the course of the work showed that the concrete strengths were above that for which the design had provided. The results were favored by the fact that the aggregates, Joliet limestone and Chilicothe sand, showed a high degree of uniformity. The cement was Atlas from the mills at Hannibal, Mo.

During the winter, the heating of the aggregates and the water with exhaust steam from the mixer plant was effective in turning out the concrete with an average temperature of about 100° F. In addition, the units of the substructure being poured were enclosed so that the concrete could be steam-cured for five days after placing, during which a temperature of 72° was maintained. In addition to the measures taken to obtain a strong dense concrete, all exposed surfaces of the substructure were given three coats of Ironite furnished and applied by the Permanent Waterproofing Company, Chicago.

Owing to the large top area of the pivot pier, it was exceedingly difficult to finish the surface at the proper elevation to the desired degree of accuracy. This problem was solved by placing the concrete in the top in three units, a center octagon under the center bearing, an outer ring under the drum bearing and an annular ring between the two which was slightly depressed to serve as a shallow gutter with outlets through eight 6-inch drain pipes leading to the outside face

of the pier. The bearing surfaces of the pier top were hand-dressed to the required elevation with a tolerance of only 0.002 foot.

Build embankment approaches.

The old bridge in flanked on the east end by a long pile trestle which proved objectionable by reason of fire hazard as well as the damage done to the piles by the action of ice. To avoid this in the new bridge without introducing an excessive length of steel viaduct, the east abutment was placed about 1 400 feet, out from the river bank, the remaining distance being occupied by an embankment to accommodate both the railway and highway roadbeds. This embankment required about 200 000 cubic yards of fill, largely rock, which was taken from a cut located about a mile east of the bridge. This filling was excavated with a 5-cubic yard Bucyrus shovel and loaded into 20-cubic yard Clark dump cars. Some of the rocks were very large, with occasional pieces as much as 10 feet long, but they were loaded and handled with no particular difficulty.

Owing to the width of the embankment, il was found desirable to build a filling trestle along each side and complete the fill by spreading toward the center. Spreaders proved inefficient for this heavy material, better success being attended by the use of ditchers to push the piles of material down the slope.

The entire bridge, both substructure and superstructure, was designed in the office of A. F. Robinson, bridge engineer, Atchison, Topeka & Santa Fe System, under his direct supervision. H. W. Wagner, chief engineer, Atchison, Topeka & Santa Fe, eastern lines, and his assistants, were in charge of the construction work, R. A. Van Ness being assistant engineer in the field. The substructure, including the draw rest, shear booms and the concrete floor for the highway deck, was built under contract by the Union Bridge and Construction Company of Kansas City, Mo. The superstructure was designed and built by the American Bridge Company.

Bridge and building forces of the railroad placed the open and ballast deck and also did all field painting of the steel work. The entire cost of the project is approximately five and one-half million dollars.

[621 .33 (.45)]

The electrification of railways from the point of view of national economy,

By Francesco BALATRONI,
ENGINEER.

(*Rivista dei Trasporti.*)

1. *Foreword.* — The problem of making the best use of fuel requires in all branches of national activity the most attentive care if the most efficient results are to be obtained from the fuel imported; it also demands the widest and most scientific use of the few deposits in Italy, and the substitution of the greatest possible quantity of energy from hydro-electric plants for that given by heat.

The increase in the consumption of fuel is an indication of the steadily increasing

activity of the country, and instead of being alarmed thereby, it should be a subject for satisfaction and pride : only every kilogram of coal ought to be burnt so as to give the maximum useful result; each kilowatt-hour ought to be used to replace the largest quantity of coal; if these two conditions are fulfilled the growth of wealth and wellbeing will be to the greatest degree

One of the most important and interesting problems in the substitution of fuel by energy supplied by hydro-electric stations is that of the *electrification of the railways:* it is enough to remember that steam locomotives burn for equal power much more coal than good stationary engines. It follows that a given quantity of electric energy if used by the railways saves much more coal than if it had been used to replace stationary engines.

Taking the consumption of electricity per virtual ton-kilometre to be 0.03 kilowatt-hour, and knowing that the annual traffic on the 16 000 km. (9 900 miles) in round figures, of the Italian railways is about 40 milliards of virtual ton-kilometres (24.5 milliards of ton-miles), the complete conversion of this system (without counting the railways and tramways worked by private companies) would absorb about 1 200 million kilowatt-hours annually, or about ten times the energy consumed by the 900 kilometres (560 miles) already electrified. This is an enormous quantity of energy which, although not impossible to supply, could not be obtained from hydro-electric plants for a long time to come, especially as many industries taking very large quantities could not survive if they could not obtain cheap power, and consequently also desire to take it from the hydro-electric plants. We should add that, as we shall see more clearly at the end of the note, in the case of many railways and tramways electrification, whilst usefully replacing fuel, is industrially bad business.

Seeing that, as *Metron* has well said in the remarkable and outspoken article published by the *Corriere della Sera* of the 3 January 1927, one should act *as one can and in measure as one is able*, it is desirable the lines to be electrified be chosen with care, beginning with those the conversion of which will shew the greatest advantages.

We propose to study the conditions governing this choice, avoiding in the course thereof the usual habit of using averages taken from the working of a Company which, being often a mean of values of different kinds, can be wide of the different individual values, and also as a consequence of the conditions on the line to be investigated.

2. *General formula.* — Let us take a steam railway on which during the year trains of different types run : passenger trains, fast goods trains, and slow goods trains, for example Let n be the basic number of trains of one kind, P the average load hauled and π the weight of the locomotive having an adhesive weight of π_a. Let us make $\delta = \frac{\pi_a}{\pi}$.

The real kilometric traffic in the *loading section* considered can be expressed by

$$T = \Sigma n\,(P + \pi) = \Sigma n \left(P + \frac{\pi_a}{\delta}\right).$$

If P and π represent tons, T represents the ton-kilometres per kilometre.

As the line considered is in actual operation we know (and it is therefore useless to deduct it from theoretical considerations or from statistics relating to railway systems as a whole), the quantity of coal that the line or the loading section to be studied consumes with the traffic T, on an average on each kilometre, shunting, starting, stopping, heating, etc , included, and taking into account all work done. By dividing this consumption by T, we get the fuel used per real ton kilometre which we will designate q and will suppose to be in kilograms. If k is the price of a kilogram of coal burnt in the locomotive, the cost of fuel is qk.

Let us now suppose that the same traffic nP of one type of train be divided between n_1 electric trains weighing P_1, with locomotives of a total weight π_1 and adhesive weight π_{a_1}. The ratio of these two weights: $\delta_1 = \frac{\pi_{a_1}}{\pi_1}$ is frequently unity.

If e_1 is, in kilowatt-hours, the consumption of electric energy at the driving wheels per real ton-kilometre, the average consumption at the trolley will be for the whole traffic :

$$e = \frac{\Sigma \frac{1}{\eta_1} n_1 (P_1 + \pi_1) e_1}{\Sigma n_1 (P_1 + \pi_1)}$$

η_1 representing the coefficient of efficiency of the electric locomotive. If further k_1 be the cost of the kilowatt-hour at the trolley the cost per kilometre per ton of train of the electric energy consumed will be

$$k_1 e = k_1 \frac{\Sigma \frac{1}{\eta_1} n_1 (P_1 + \pi_1) e_1}{T_1}$$

where T_1 represents the new traffic

$$\Sigma n_1 (P_1 + \pi_1).$$

When determining e_1, we should include therein the consumption by accessories reduced to the kilometre and to the ton basis.

If we suppose electrification costs per kilometre of track, C lires and that r is the annual charge due to interest, upkeep, and amortization of the capital (account should not be taken of amortization unless the electrification is done by a contractor and then only from the contractor's point of view).

Let β be the proportion per cent of the line the service lines which should also be electrified represent.

As index of the advisability of electrifying, we can accept the ratio :

$$\gamma = \frac{k_1 e T_1 + (1 + \beta) r C}{k q T}$$

which can be written

$$\gamma = \frac{k_1}{k} \cdot \frac{e}{q} \cdot \frac{T_1}{T} + \frac{(1 + \beta) r C}{k q T} \quad . . \quad (1)$$

If the ratio γ is less than unity, electrification is to be recommended on grounds of economy, and increasingly so as γ becomes less. If, on the other hand, $\gamma > 1$, the conversion will not be profitable, and the less so as γ becomes greater

If instead of the actual traffic, we wish to use the virtual traffic, e and q would be divided and T_1 and T multiplied by the virtual coefficient, so that the value of γ would not change. It should be noted that this would still be true for both traction systems when different virtual coefficients are used. The introduction of the virtual line is therefore an unnecessary complication.

It is necessary to know the value of the ratios

$$\frac{T_1}{T} \text{ et } \frac{e}{q}.$$

3. *Calculation of*

$$\frac{T_1}{T} = \frac{\Sigma n_1 (P_1 + \pi_1)}{\Sigma n (P + \pi)}.$$

If p is the gross weight hauled for each unit of adhesive weight, the total weight of the train per unit of π_a is $p + \frac{1}{\delta}$. On a gradient of i_m taken as the base on which, in the loading section considered, the train should be made up (maximum theoretical gradient, excluding any up gradient which can be run over by momentum) we have, for $\pi_a = 1$:

$$\left(p + \frac{1}{\delta}\right)(w + i_m) = 1\,000 f,$$

in which w is the coefficient of tractive resistance on the up gradient on straight line and f the coefficient of adhesion. From this we get :

$$p = \frac{1\,000 f - \frac{1}{\delta}(w + i_m)}{w + i_m}.$$

For other values of δ and f, such as δ_1 and f_1 (electric traction) we have

$$p_1 = \frac{1\,000 f_1 - \frac{1}{\delta_1}(w_1 + i_m)}{w_1 + i_m}.$$

an equation in which w_1 differs from w because this coefficient depends upon the speed which may be different.

Since for each type of train, the total weight hauled is, as a whole, the same with the two systems of traction, the corresponding number of trains will be inversely proportional to the values of p :

$$\frac{n_1}{n} = \frac{p}{p_1} = \frac{w_1 + i_m}{w + i_m} \cdot \frac{1\,000f - \frac{1}{\delta}(w + i_m)}{1\,000f_1 - \frac{1}{\delta_1}(w_1 + i_m)} \quad (1')$$

In this way suppose the adhesive weight is supposed to be the same in two corresponding trains.

For the whole of the trains of a type, the total weight of the rakes hauled is the same with the two methods of traction; what changes is the weight of the tractors only, and this from

$$n\pi = n\frac{\pi_a}{\delta},$$

becomes

$$n_1\pi_1 = n_1\frac{\pi_{a_1}}{\delta_1} = n_1\frac{\pi_a}{\delta_1}$$

because, as we have said,

$$\pi_{a1} = \pi_1.$$

The ratio between the weight of the tractors of each type is then

$$\tau = \frac{n_1}{n} \cdot \frac{\delta}{\delta_1} = \frac{w_1 + i_m}{w + i_m} \cdot \frac{1\,000f\delta - (w + i_m)}{1\,000f_1\delta_1 - (w_1 + i_m} \quad (2)$$

	for $i_m =$	0	10	20	30	40	50 ‰
if $\delta = 1$,	we have $\tau =$	0.71	0.69	0.67	0.65	0.63	0.61
if $\delta = 0.75$,	we have $\tau =$	0.52	0.50	0.47	0.44	0.40	...
if $\delta = 0.50$,	we have $\tau =$	0.34	0 31	0.27	0.22	...	...
if $\delta = 0.25$,	we have $\tau =$	0.16	0.11	0.06	...	...	...

(2″)

We have neglected the values of τ which correspond to combinations of i_m and δ not found in practice.

This table shews that *the advantage of electric traction is so much the greater as the gradients on the line are heavier*. It increases therefore more quickly as δ diminishes, that is to say, on important lines on which the locomotives take fuel and water at widely separated places and on which the speeds are high. This part of the advantage is that which is lost and even becomes a disadvantage when the electric traction is assured by means of accumulators since the weight of the locomotive, or of the carrying vehicle which is not used for adhesion, acts as the non-adhesive weight of the steam locomotive. With overhead or third rail traction, the ability to use the total weight of the locomotive

Finally,

$$\frac{T_1}{T} = \frac{Q + \Sigma n\tau\pi}{Q + \Sigma n\pi} \quad \ldots\ldots \quad (3)$$

in which Q is the total weight ΣnP of the rakes hauled common to T and T_1.

It should be noted, which is of course evident, that if Q were divided, as much with electric as with steam traction, in numbers of trains in different ratio to that supposed here (which corresponds to the case $\pi_{a1} = \pi_a$) there would be no change in the ratio $\frac{T_1}{T}$. Actually in equation (3), both in the numerator as in the denominator, n and π would vary in inverse proportion and would not affect the values of the terms of the fraction. The ratio τ is independent, provided the tractors have just the correct adhesive weight, of the method of distribution of the load in the trains of each type, but it is independent in separate ways for steam traction and electric traction.

As for example, if there was one single type of trains having the same speed with the two methods of traction ($w_1 = w$), we should get :

$$\tau = \frac{1\,000f\delta - (w + i_m)}{1\,000f_1\delta_1 - (w + i_m)} \quad \ldots \quad (2')$$

So, if

$$f = \frac{1}{7},\ f_1 = \frac{1}{5},\ w = 5 \text{ et } \delta_1 = 1 :$$

for adhesion can be taken full advantage of.

For the two methods of traction we then have (if $w_1 = w$) :

(Electric)

$$\Sigma n\,(P + \tau\pi)\,(w + i_m) = 1\,000\,\Sigma n f_1 \delta_1 \tau\pi$$

(Steam)

$$\Sigma n\,(P + \pi)\,(w + i_m) = 1\,000\,\Sigma n f \delta\pi.$$

From these equations in which, in accordance with the observation made above, we suppose $n_1 = n$ and $P_1 = P$, we get the relation :

$$\frac{\Sigma n\,(P + \tau\pi)}{\Sigma n\,(P + \pi)} = \frac{T_1}{T} = \frac{\Sigma n f_1 \delta_1 \tau\pi}{\Sigma n f \delta\pi} \quad . . \quad (4)$$

In order to have some idea of the order of magnitude of this ratio, let us suppose one single type of train, and let

$$f = \frac{1}{7},\ f_1 = \frac{1}{5},\ \delta_1 = 1.$$

We shall get $\dfrac{T_1}{T} = \dfrac{7}{5} \cdot \dfrac{\tau}{\delta}$.

With the values of table (2'') :

	for i_m =	0	10	20	30	40	50 ‰
if $\delta = 1$,	we have : $\frac{T_1}{T}$ =	0.99	0.97	0.94	0.91	0.88	0.85
if $\delta = 0.75$,	we have : $\frac{T_1}{T}$ =	0.97	0.94	0.88	0.83	0.74	...
if $\delta = 0.50$,	we have : $\frac{T_1}{T}$ =	0.95	0.87	0.76	0.62	...	...
if $\delta = 0.25$,	we have : $\frac{T_1}{T}$ =	0.90	0.67	0.34	...	...	...

. . . . . (4')

These figures give an idea of the influence that the electrification has on the total traffic, an influence which *grows, to equality with* δ, *as* i_m *increases, and the more rapidly as* δ *is smaller; it grows, to equality with* i_m, *as* δ *diminishes and the more rapidly as* i_m *is greater.*

4. *Calculation of the ratio* $\frac{e}{q}$. — To determine the consumption e of electric energy per ton-kilometre, a diagram can be constructed of the total energy consumption based on the time table, the longitudinal profile and layout of the line and the running conditions of the trains. On the other hand, it may be noted that the ratios $\frac{e}{q}$ can only vary between narrow limits because these limits depend solely on the differences of speed and make up of the steam and electric trains.

We can proceed with sufficient accuracy as follows : in the loading section considered there will be a number of up gradients of the base length l, in kilometres, and gradient of i ‰, with a certain number of curves of base length l' of unit resistance w_c given by the well known tables and formulæ. In one direction the additional resistances due to the line are : $\Sigma li + \Sigma l' w_c$, and in the other : $\Sigma l\,(-i) + \Sigma l' w_c$, that is for the whole, supposing the traffic equal in both directions $\Sigma li + \Sigma l\,(-i) + 2\,\Sigma l' w_c$.

This resistance, in relation to the length of the loading section can be considered as a slope i_1 (as the slope i_1 ‰ is always approximately equal in the case of adhesion lines to a resistance of i_1 kgr. per ton) given by

$$i_1 = \frac{\Sigma li + \Sigma l(-i) + 2\Sigma l' w_c}{L} \quad . . \quad (5)$$

The terms li and l are replaced as usual by $\frac{1}{5}\,i$ when, running downhill, $i > w$. For electric traction, this value is perhaps too high ; it certainly is when current is recuperated (this question we leave on one side here) in view of the economy this method

shews over braking, and in consequence on the corresponding consumption of energy and stores. The distance travelled by the trains with regulator shut or with current off (*coasting*) and during braking, can in each direction be considered whatever be the effective gradient, as an up gradient, with $i > w$.

With recuperation of electric energy, it is recommended to eliminate from Σli and and $\Sigma l\,(-i)$ all the terms with $i > w$ during the descent of the gradient.

In the loading section considered the train has to stop at N stations. If V is the booked speed in kilometres per hour, and α the inertia of the unit of weight of the train, the starting of the train requires a consumption of energy equal to $\frac{1}{2} \cdot \frac{\alpha}{g} \cdot \frac{V^2}{(3.6)^2}$, and since in the two directions there are 2N stops, this is equivalent, per kilometre of line, to an average resistance per ton, still expressed under the form of a gradient

$$i_2 = \frac{N}{L} \cdot \frac{\alpha}{g} \cdot \frac{V^2}{(3.6)^2} \quad \ldots\ldots \quad (6)$$

Taking

$$i_0 = i_1 + i_2,$$

the average unit effort becomes

$$z = w + i_0 \quad \ldots\ldots\ldots \quad (7)$$

This said, let us consider two trains, one steam, the other electric, of the same type. The speed will be about the same, but the resistance w will vary appreciably owing to the different composition : let w and w_1, be the two values.

Similarly, i_0 will be different because for the electric locomotives, α_1 has a higher value than in the case of steam locomotives, and as a consequence of the final differences in speed which have a marked influence on i_2.

We shall have therefore for the steam train

$$z = w + i_0$$

and for the electric

$$z_1 = w_1 + i'_0.$$

For the first, let us determine experimentally the consumption of coal per average real ton-kilometre on the loading section and let us take :

$$q_1 = \bar{q}\,(w + i_0).$$

We can agree that for another train with a similar locomotive, w and i_0 vary with the speed, the composition, the number of starts, but $\bar{q}$ does not.

For the electric trains, evidently :

$$e_1 = \frac{0.736}{75\eta} z_1 = \frac{0\ 736}{75\eta} (w_1 + i'_0).$$

It is clear that $\bar{q}$ corresponds to an efficiency of the steam locomotive which can in fact be considered as almost constant. The efficiency η varies also with the electric locomotives as with the frequency of the stops, and the starting conditions because it includes the consumption of electric energy in the resistances and the transformers of these locomotives. However η also varies slightly.

Whe shall have therefore :

$$\frac{e}{q} = \frac{\dfrac{0.736}{75} \cdot \dfrac{\Sigma \dfrac{1}{\eta} n\,(P + \tau\pi)\,(w_1 + i'_0)}{T_1}}{\dfrac{\Sigma \bar{q} n\,(P + \pi)\,(w + i_0)}{T}}$$

or

$$\frac{e}{q} = \frac{0.736}{75} \cdot \frac{T}{T_1} \cdot \frac{\Sigma \dfrac{1}{\eta} n\,(P + \tau\pi)(w_1 + i'_0)}{\Sigma \bar{q} n\,(P + \pi)(w + i_0)} \quad (8)$$

More simply, we can make use of the value of q derived from the working of the line and calculate

$$\frac{e}{q} = \frac{0\ 736}{75} \cdot \frac{\Sigma \dfrac{1}{\eta} n\,(P + \tau\pi)(w_1 + i'_0)\,1 + \varepsilon}{q' T_1} \quad (9)$$

in which we have used the constant $(1 + \varepsilon)$ to take into account the consumption included in q in steam working and which are not included when determining e :

brakes, shunting, heating, etc. The ratio $\frac{e}{q}$ will thereby become less accurate : but since it varies little it can be equally well used.

In the second term of equation (1) q is the mean total consumption of coal per real ton-kilometre, including all accessory consumptions, and is determined by the operation of the line

Generally. the ratio $\frac{e}{q}$ is to-day far not from $\frac{1}{2}$, e being expressed in kilowatt-hours and q in kilograms.

5. *Application of the formula* (1). — If for example $k = 25$ centimes and $k_1 = 15$ c., and in consequence $\frac{k_1}{k} = \frac{3}{5}$, taking $\frac{e}{q} = \frac{1}{2}$, the first term of the second group of (1) becomes $\frac{3}{10}\frac{T_1}{T}$ and for the values of the table (4') :

	for $i =$	0	10	20	30	40	50 ‰
if $\delta = 1$,	we have $\frac{3}{10}\frac{T_1}{T} =$	0.30	0.29	0.28	0.27	0.26	0.25
if $\delta = 0.75$,	we have $\frac{3}{10}\frac{T_1}{T} =$	0.29	0.28	0.26	0.23	0.22	...
if $\delta = 0.50$,	we have $\frac{3}{10}\frac{T_1}{T} =$	0.28	0.26	0.23	0.19	...	..
if $\delta = 0.25$,	we have $\frac{3}{10}\frac{T_1}{T} =$	0.27	0.20	0.10	...	...	...

. . . (10)

Obviously there is nothing absolute in these values because they depend on the values selected for the purpose of calculating them ; they give however an idea of the order of magnitude of this first term.

The second term of formula (1) includes :

— the constant $(1+\beta)$ which for each line is definitely known and which on railways generally lies between 1.10 and 1.20;

— the rate r which varies with the rate of interest on the capital and the prevision made for maintenance and renewals. Without taking into account amortization (which, as we have said above, only concerns the eventual concessionnaire) we can agree that r fluctuates slightly round about 0.10;

— C and k which vary from one date to another, but always together, so that it is as well to consider the ratio between them this being much less variable than the terms themselves. In effect, especially during periods of fluctuations of money values, C as well as k vary therewith, but end in the same relative position after these fluctuations, at least in the long run. We can then say that the ratio $\frac{C}{k}$, applied to a sufficiently long period of time remains practically constant. This fact is important, as if it were not so, the investigation of the opportuneness of electrification would only have a value at the particular time it was made, whereas for these reasons these conclusions can be applied to an indefinite period, since we can consider the eventual increase of the ratio $\frac{C}{k}$ to be subsequently compensated for by the increase of T, which occurs continually and obviously exercises an influence in favour of the electric working. If, for railways C = 250 000 lires, and if $k = 0.25$, we have $\frac{C}{k} = 1\ 000\ 000$.

For tramways, C even to day can be appreciably smaller: for important railways it may be greater : in consequence this ratio varies with the type of railway,

but for any one type it can be taken as varying little :

— q which varies per real ton-kilometre with the line, but which is accurately known, as it is determined from the actual working of the line considered.

If we suppose $1 + \beta = 1.2$, $r = 0.1$, $\frac{C}{k} = 1\,000\,000$, we get for the second term of the formula (1) the value :

$$\frac{120\,000}{q\Gamma} = \frac{120}{\Omega},$$

in which Ω represents the annual consumption of coal in tons per kilometre.

With these values, we should find $\gamma = 1$ when :

	for $i_m =$	0	10	20	30	40	50 ‰
if $\delta = 1$,	$\Omega =$	765	684	545	500	444	414
if $\delta = 0.75$,	$\Omega =$	684	545	444	387	308	...
if $\delta = 0.50$,	$\Omega =$	571	444	353	250	...	...
if $\delta = 0.25$,	$\Omega =$	480	273	167	...	...	..

. . . . . (11)

By dividing by q (consumption of coal per real ton-kilometre) in kilograms, we get in thousands of tons per kilometre and per annum, the limiting traffic beyond which electrification is to be recommended. Many important railways exceed the consumption per kilometer which marks the limit at which electrification is profitable : but many light railways and tramways remain much below it. For these latter, the conversion is a mistake economically : for the former it is profitable and increasingly so as the value of Ω increases.

The method given above abandons the habitual use of the virtual traffic and the average consumptions of coal and electric energy per virtual ton-kilometre. These consumptions, as we said at the beginning of this article, differ largely from one line to another because they are affected by the frequency of the stops and by the composition of the trains.

The course followed here is to take account of the real operating figures of the steam railways, and to foresee the train movement of the electric trains which will be substituted for the steam trains. In this manner, account is taken of the reduction in weight of the trains by the reduction or elimination of the non adhesive weight of the tractors, and by the constant motor effort which, with electric traction, allows a higher adhesive factor to be counted on.

6. *Increase in capacity of the line.* — We can deduce from equation (2') that the number of electric trains n_1 expressed as a function of the number of steam trains n is, for equal adhesive weight and for the whole train movement :

$$\Sigma n_1 = \Sigma n \cdot \frac{w_1 + i}{w + i} \cdot \frac{1\,000 f - \frac{1}{\delta}(w + i_m)}{1\,000 f_1 - \frac{1}{\delta_1}(w_1 + i_m)} \quad (12)$$

In actual working, with the electric locomotives the powers developed and the speeds attained are always higher. It is not too much to admit, as we did implicitly in equation (12), that the power of the electric locomotive is greater than that of the steam locomotive by the quantity necessary to haul the greater weight of the rake of vehicle due to the higher coefficient of adhesion and the conversion into useful weight of the non adhesive weight of the steam locomotive which does not exist in the case of the electric locomotive. Frequently one could adopt for the electric locomotives still greater powers and still heavier weights than formula (12) indicates, and reduce still further the number of trains : and also we could adopt higher speeds than those at present in use, whence a further increase in capacity of the line.

Even if for prudence we keep to for

mula (12), and we suppose $w_1 = w$ and one single category of trains, we shall have :

$$\frac{n_1}{n} = \frac{1\,000f - \frac{1}{\delta}(w + i_m)}{1\,000f_1 - \frac{1}{\delta_1}(w_1 + i_m)}.$$

If $w = 5$, $\delta_1 = 1$, $f = \frac{1}{7}$, $f_1 = \frac{1}{5}$:

	for $i_m =$	0	10	20	30	40	50 ‰
with $\delta = 1$,	$\frac{n_1}{n} =$	0.71	0.69	0.67	0.65	0.63	0.61
with $\delta = 0.75$,	$\frac{n_1}{n} =$	0.70	0.66	0.63	0.58	0.54	...
with $\delta = 0.50$,	$\frac{n_1}{n} =$	0.68	0.61	0.54	0.44	...	..
with $\delta = 0.25$,	$\frac{n_1}{n} =$	0.63	0.45	0.25	...	...	...

. . . . (13)

The lines with easy profiles rarely use locomotives with $\delta = 1$; when this case occurs it is found on light railways and tramways. On lines with light gradients, the case of $\delta = 0.75$ is also unusual. In the same way, on lines with 1 in 50 gradients, it can be considered exceptional if $\delta = 0.25$ (value furthermore extremely rare in all the cases) and in lines of 1 in 33, $\delta = 0.50$ is also not frequently found.

We can then say that $\frac{n_1}{n}$ varies between $\frac{2}{3}$ and $\frac{1}{2}$.

We should also avoid attributing to these numerical values too general an importance, because they depend upon the hypotheses made for simplification and the values taken to arrive thereat : nevertheless they shew the importance electrification can have in increasing the capacity of the line, and which may translate itself by considerable economic advantage in the case of lines actually congested by traffic. On these lines, if steam traction is to be retained, the methods of train protection and the block system being supposed to have been installed already as they bring the output capacity to the maximum, it would be necessary to add another line. If the block system has not yet been installed, recourse may be made to it to increase the number of trains. In all events, it would be necessary to invest a capital C_1 per kilometre. When considering the curve representing the traffic, it is possible to foresee for how many years this measure can be postponed in expectation of the electrification of the line and the increase of power which results therefrom : if the number of years is n_1, the electrification saves a sum of interests

$$S = C_1\left(1 - \frac{1}{(1 + r_1)^{n_1}}\right)$$

in which r_1 is the rate of interest, upkeep and repayment of the capital C_1.

The sum S is taken from C in (1).

If $r_1 = r$:

$$\gamma = \frac{k_1}{k} \cdot \frac{e}{q} \cdot \frac{T_1}{T} + \frac{(1 + \beta)\, r\,(C - S)}{kqT} \qquad (1')$$

It is not unusual for S to be $> C$ and for the electrification, instead of causing an increased outlay, to procure a reduction.

7. *Classification of railway lines.* — In order to classify the railway lines in accordance with the opportuneness of electrification, the following order will probably be observed, numerical results being ignored:

a) Lines already overloaded, requiring the addition of one or several lines;

b) Lines already overloaded, the capacity of which can be increased by means of cheaper methods than increasing the number of lines, that is to say, by means of the block system;

c) Lines with little traffic, but having a heavy coal consumption per kilometre;

d) Lines having a low consumption of fuel per kilometre

In each of the categories given above, a sub-division can be made based, not only on the cost for additional lines and the block system, but above all on the quantity of coal used per kilometre, and consequently on the traffic and the profile of the line. This last element adds to the factor a another influence in that it affects the make up of the trains.

A given traffic can be assured, either by a certain number of heavy trains, or by a greater number of lighter trains, as occurs on those lines which for the particular requirements of the passenger services need a large number of light trains in the working.

On the other hand, in the present state of civilisation, the conversion of these latter lines is often a necessity.

It is often suggested that one of the advantages of electrification is the rapid increase in the traffic, and in particular in that of passengers that results. The fact is correct: but it is only indirectly due to the electrification: it is rather due to the increase in the number of trains started electrification makes possibles. But even with steam traction there would be no technical difficulty in operating more intense time-tables, as we are here dealing with lines wich are far from being fully loaded. If the traffic can be increased by the electrification of the line, this is equivalent to saying that at the moment it is not being worked as the public wishes, and the reason is that the increase in the receipts would not compensate for the increased expenditure that a greater number of trains would entail We shall see in the following paragraph that with electric traction, an increase in the number of trains is between certain limits less costly than with steam traction. The comparison will therefore be made presupposing the same train movement on the electrified line as on the steam line: from this fact, the second will be more heavily loaded than the former, but the useful work will be identical.

On the other hand, the tractor is different, as it has neither the same factor of adhesion nor the same proportion of the total weight.

In this case, it would be necessary to calculate q which can differ more or less from the present day value. In fact, the much lighter weight of the trains will certainly suggest the use of lighter locomotives than those now used, without saying that the ratio between the weight of the locomotive and that of the train will not change as well: in order to give the public equal service with the two train movements, steam and electric, we have taken similar speeds and the same loss of time at starting.

The correction of the actual value of q can, approximatively, be calculated as follows; supposing the consumption of coal as proportional to the resistances opposing the forward movement of the present train, and of one of those replacing it (lighter but still steam drawn) and extending the hypothesis to the whole train movement we have:

$$q_1 = q \frac{\Sigma n_1 [P_1 (w' + i_0) + \pi_1 (w'' + i_0]}{\Sigma n (P + \pi) (w + i_0)} \quad (14)$$

wherein w' and w'' are the unit resistances of the rake hauled and of the locomotive at the speed of the electric trains, and w

the average resistance of the present trains.

The total traffic of the line with steam operation instead of being T, becomes :

$$T_1 = \Sigma n_1 (P_1 + \pi_1)$$

and the total consumption of coal :

$$\Omega_1 = q_1 T_1$$

so that we get

$$\gamma = \frac{k_1}{k} \cdot \frac{e}{q} \cdot \frac{T_1}{T} + \frac{(1+\beta) rC}{k q_1 T_1} \quad . \quad (1'')$$

In everything we have considered so far, we have ignored the saving in enginemen that can be effected with electric traction, and also those that result therefrom in ordinary maintenance and at the engine sheds.

Against these savings are set off the expenditures for the supervision of the distribution and contact lines and the sub-stations. This is allowed for in r of the upkeep of the stationary electrical plant. Account may also be taken when fixing r of the ultimate difference, positive or negative, between the said expenditures by dividing this difference by the length of the line, increased in the ratio $\frac{1+\beta}{1}$ and in adding the quotient to the capital C : this will give the correction to be made to r.

8. *Light railways and tramways.* — In the above we have considered railways with intense traffic, and consequently we have not taken account of the advantage that can be obtained with electric traction from the increase in the number of trains above that the traffic demands. An increase of this kind is never economical with steam traction because, even if the weight of the locomotives is exactly proportional to the load, the increase in the number gives rise to greater outgoings without procuring any economy : it is only done in so far as it is necessary to meet the insistent demands of the public, and also, as we have seen in the preceding paragraph, so that a comparison can be made with electric traction under conditions of equal work done. On the other hand, putting aside the traffic requirements, the increase in the number of trains started, and the reduction of weight of the trains which is the consequence, can be an advantage in the case of electric traction.

In the above, the number of trains was that needed to meet traffic requirements and, on the electrified line, it is only by a careful study of the time-tables that we can ask for uniformity of consumption of energy in unit time, which translates itself by lowering the peak consumptions, the onerous factor in the supply of energy which sometimes makes it necessary to raise the tariffs. The intensity of the traffic furthermore makes it necessary, on the lines first considered for there to be at any given moment, in each section of the line included between two sub-stations, two or several pairs of trains, and then the advantage of a subsequent subdivision of the electric trains is very slight.

But on lines with limited traffic it can happen that all the sections are not occupied by a pair of trains at the same time. In this case it may be beneficial to increase the number of trains with a view to ensuring a pair of trains being in each section.

In effect, the energy absorbed by each of the n_1 trains which are used to transport a gross load Q is, for each pair :

$$\left(\pi_1 + \frac{Q}{n_1}\right)(w_1 + i_0) v + \left(\pi_1 + \frac{Q}{n_1}\right)(w_1 + i'_0) v'$$

v and v' designating the speeds and i_0 and i'_0, the additional resistances in the two directions If we suppose w and v independent of n_1 (in reality w increases as n_1 diminishes) it becomes evident that the energy absorbed from one sub-station by the trains which run over the two adjacent sections (of equal length and with the same i_0 and i'_0 constant) is so much the less as n_1 becomes larger. The energy taken, ignoring starting, braking, and recuperation, would be on the contrary,

constant and minimum when the two trains in each direction maintain constantly between themselves a distance equal to the length of one section. In the same way, we can take π_1 as diminishing as n_1 increases, provided that for the lighter trains lighter and less powerful tractors are chosen.

Although the position is less simple than the above considerations would lead us to believe, and undergoes, furthermore, modifications due to several causes that will not be considered here, it is true that until it is possible to have a single pair of trains at the same time in each section, it will be disadvantageous, with steam traction, to increase the number of trains With electric traction, doing so may lower the instantaneous value of the consumption, give a more uniform distribution over the day, and at the same time enable smaller sub-stations to be provided with cheaper distributing lines, and sometimes with more favourable prices for the supply of energy.

This advantage, however, has to be paid for by the necessity for building or buying and maintaining a greater number of tractors, the price per ton of which increases inversely as the weight, the more numerous staff for the locomotives and the trains, with other inconveniences. There is then a number n_1 of electric trains which meets the conditions best, whilst with steam traction n is simply the number required by the traffic.

Let us now suppose that the traffic exceeds that which can be handled with a pair of trains in each section at any given moment. It is easy to see that nothing will be gained even with electric traction, by running other trains, and that it would be better on the contrary, as far as possible, to strengthen the former. If this is not practicable, it is advisable to redistribute the total traffic over $2\,n_1$ trains and allow at the same time two (in each direction) in each section at a suitably chosen distance apart.

The energy absorbed at each moment, admitting uniform consumption, will be the double of that taken by one of the pairs of trains. This service will be suitable up to the upper limit of loading of each of the $2\,n_1$ trains in each direction; but subsequently it would be necessary to distribute the total load between $3\,n_1$ trains in each direction, and so on. Now it is clear that the peak consumptions due to an irregular distribution of the loads of the trains and of the loads on the line, in relation to the consumption, become as much less as the number of trains found at a time in each section is greater, or otherwise stated, as the traffic is more intense.

This confirms what we said above : the importance of the regular distribution of the consumption of electric energy as regards time diminishes as the traffic increases : it is then with good reason that we have not taken it into account in the preceding paragraphs because, even on important lines, owing to the different speeds of the trains and working requirements, the regularity in question cannot be realised in practice.

On lines with little traffic, these considerations may also have a certain value. The conclusion is that *if the number of trains which is most suitable for electric traction is higher than that required by the services, the first number is the one that should be used, whilst the second would be more suitable for steam traction. If, on the other hand, the required number of trains is higher than that which is best for electric traction, it is this first figure that should be adopted both for electric and for steam traction*, and we again have the case considered in paragraph 7.

In each case, then, the formula (1) can still be applied : except that the coefficient τ of équations (2) and following is deducted from n' and n fixed as we have said. There is no other change in the calculation of the other elements of the expression (1).

So as to form an idea of the probable result of the investigation into the op-

portuneness of electrification of light railways and tramways, as well as of secondary lines with moderate traffic, let us take some examples, using the simplified conditions most favourable to electric traction. Let $n_1 = n$ and $\delta_1 = \delta = 1$, that is to say, let us suppose that on the steam line tender locomotives with their whole weight available as adhesive weight are also used. We then have $\tau = 1$. Let $k = 25$ centimes, $k_1 = 15$ centimes, whence $\frac{k_1}{k} = \frac{3}{5}$. Let us suppose that with the actual working we have $q = 0.1$ kgr. per real ton-kilometre and that e calculated as in paragraph 4 be 0.05 kilowatt-hour for the same work. We get $\frac{e}{q} = \frac{1}{2}$

We then suppose $r = 0.10$, $\beta = 0.10$, and we admit that with the savings the light traffic on the line will shew that we can make C = 150 000 lires only. The equation (1) will give :

$$\gamma = \frac{3}{5} \cdot \frac{1}{2} \cdot 1 + \frac{1.1 \times 0.1 \times 150\,000}{0.25 \times 0.1\,T}$$

which gives 1 when T = 943 000 ton-kilometres approximately per kilometre.

It is only when the real traffic is higher than this value that electrification is to be recommended.

At present many light railways have not yet reached this intensity of traffic ; they are often very far from it. So that if in practice every day four pairs of trains of an average weight of 200 t. are put into service, we have T = 365 × 4 × 2 × 200 = 584 000 t.

This is the traffic of many secondary and local lines. The tramways frequently have still lighter trains.

However, it should be noted that in the case of tramways and light railways, other considerations may come into the question and may even lead to the adoption of the opposite conclusion.

We said in paragraph 7 that the increase in traffic, due to greater frequency of the trains, can be realised as well with electric traction as with steam, but that with the latter the additional trains started whilst producing the same increase in receipts involves a much greater growth in expense than the former to the extent that it is rarely profitable. We also said that this depends on the advantage that between certain limits electric traction gets from the more uniform (time) distribution, from the absorption of energy from the substations and, in consequence, from the central stations : furthermore electrification results in less cost for staff.

These facts in themselves can change the sign of the difference between the increase of the receipts and the growth of the expenditure caused by a greater train movement with the two systems of traction.

This is not all, however; with steam traction the make-up of the trains should take into account the sudden rush of traffic which sometimes occurs on short sections of the line, so that frequently the degree of utilisation of the stock is very low. Furthermore, it is necessary to use the type of locomotive required to meet the increased load. but although it is too powerful for normal conditions. The whole of the carriages required for such a service constitute an integral part of the weight hauled.

With electric motor coaches, on the contrary. a part at least, frequently an appreciable one. and sometimes the whole of the load is placed on the tractor and does not form any dead weight; in addition, when there are trailer vehicles, this load usefully helps in increasing the adhesive weight.

We can then conclude that for tramways and light railways of the same type, the problem of the opportuneness of electrification is much more complex than for railways properly speaking, the more so that frequently in the case of tramways the peculiarities of the passenger service and the requirements of the localities passed through find in electric traction other advantages which steam traction is unable to give. It should be remarked

further, that the electrification of certain tramways only draws from the available supply moderate quantities of electric energy, so that the harmful effect on the national economy by their use of a part of the energy destined for lines with heavier traffic may be quite small. Then, too, it should be considered that the public services are in fact improved by the conversion, in a way they would not be if steam traction were continued, because with this latter any increase in the number of trains put into service is more burdensome.

9. *Conclusions* — We shall limit ourselves for the reasons given above, to making conclusions regarding railways on which the present train movement is regulated by the weight of the traffic, that is to say, all the principal lines and many of the secondary lines. For the others, each case should be examined separately, taking into account the whole of the circumstances which can influence the solution of the problem and which, having only a relative and slight importance in the case of the railways, can, in that of the local lines, owing to the lightness of the other term (the virtual present traffic) become in comparison relatively greater and radically modify the conclusions.

The advantages of electrifying the railways are the following :

a) Increase of the capacity of the lines, a very large economical advantage which only concerns the lines of railways which are, or will shortly be, over loaded, and which naturally group themselves with the principal lines ;

b) The replacement of fuel, usually imported, by electric energy produced by the water power resources of the country. Taking a kilowatt-hour as replacing in each case the same weight of coal, since the cost of electrification is the same, or varies little with the importance of the line and the total traffic, it is natural that with the same capital invested we ought to obtain the maximum saving on the importation of fuel and this occurs on the lines having the greatest virtual traffic ;

c) Suppression of smoke. This is an appreciable advantage, especially on lines with long tunnels and also on those with short tunnels if the trains are frequent and follow so closely that the smoke has not enough time to escape from the tunnels during the interval of time between two trains. These two cases occur almost always, both the one and the other, on lines with heavy traffic and sometimes on those on which the weight of traffic is rather less but includes many passenger trains.

These conclusions, which confirm the classification of paragraph 7, take into account the national interest from the technical and economical point of view. The State alone, however, can judge if other considerations, social, political, military, etc., should intervene to modify them.

[621 .131.2 (.42)]

Locomotive development on British railways,

By Chas. R. KING.

(*Modern Transport.*)

The severe competition of petrol vehicles on public roads with trains on the railways justifies the present consideration of means which would permit the latter to handle traffic of up to 50 % greater tonnage but without any increase in the present rate of fuel consumption — about 11 000 000 tons per annum on British railways — or any change in the size of existing boilers or increase in their steam pressures. Mechanically, such an increase in the thermal and practical efficiency of the locomotive power of Great Britain is very simple and most readily effected with the example, already before us, of the most powerful of all express locomotives in Europe. In daily operation this engine is demonstrating the modern method of extracting more than 50 % more power from each ton of coal (of a given B. t. u.) than has, up till now, been obtained on our home railways. To the general public the fact must be a surprising one that the power obtained from each ton of coal was actually greater some thirty years ago, with the simple, low-pressure locomotives, of that day, than is realised now by the extremely complex multi-cylinder, high-pressure, high-superheat locomotives, as recently tested in Britain and America, even though the latter are fitted with every conceivable device tending to save fuel and increase the power output per ton of coal. Actually, the very best of the high-pressure modern locomotives in Britain and America cannot maintain more than 20 H. P. per ton weight of loaded engine (excluding the tender), as compared with from 28 to 30 H. P. per ton as usual when 50 % more work is extracted from each ton of coal by means of a double expansion of the steam.

Comparison with thirty years ago.

According to the engineering newspapers of 1896 and 1897, the locomotives with two cylinders then working with saturated steam of 160 lb. per square inch boiler pressure, consumed from 18 to 19 lb. saturated steam per indicated horse-power, per hour of work in express service. Now, thirty years later, the best test results obtained in this country and America, in large modern engines using highly-superheated steam at 225 lb. and 250 lb. pressure per square inch is 21 lb. superheated steam per indicated horse-power hour, in non-stop express runs, although the general average best result remains at present about 23 lb. It has here to be remembered that 19 lb. steam, dry saturated, at 160 lb. per square inch represents $19 \times 1195.9 = 22\,722$ British thermal units in steam for each horse-power hour, whereas steam as now superheated by an average of + 200° Fahr. at 225 lb. gauge pressure and requiring a minimum of 21 lb. of steam per horse-power hour (Great Western Railway test trips) represents $21 \times 1\,312.8 = 27\,568$ British thermal units for each horse-power hour—which is equal to 20 % more heat than in the case of the low-pressure saturated locomotives of thirty years ago.

Experiments of the Continent.

Actually, however, the difference in the favour of the saturated engines of from 25 to 30 years ago is not so great as this, for, during the years 1906 to 1910 very extensive comparisons were made in Germany, France and Italy between the then existing double-expansion locomotives using saturated steam and the then new Schmidt superheater locomotives, all having the same number of cylinders and of the same weight and of the same boiler pressure; and according to the published railway statistics, based on the million-ton miles run with these similar locomotives, all operating the same traffic on the same lines, the average, net superiority of the saturated-steam locomotives was only from 4 to 6 %, but with 30 % average greater capacity to recover time, during actual running, from periods lost by inadvertent delays. As, however, at that time, there were world-wide financial interests in the control of patents for superheaters and there were, on the contrary, no patent interests in the more economical compound system, the latter was dropped as current practice until after the war, when, at last, the importance of fuel became so urgent that Italian, Belgian and German railways reintroduced the second expansion but retained the superheaters. The result, as published in foreign technical journals, was that the work done at the dynamometer was, and is, 54 % greater than that which, under the most favourable of conditions, can be averaged by a single expansion of the superheated steam.

Comparison with electric operation.

In the case of the Prussian railways the heavy express trains on the Berlin-Hanover services were operated at little over 12 lb. of superheated steam per indicated horse-power hour, or practically the same as that claimed by the London Electric Railways for their stationary turbine plants (2 lb. coal per kw.-h.). This consumption of 12 lb. is still regarded as a moderate one for large turbo-electric stations, although the most recent, very large, turbine plants on the Continent, worked at extremely high pressures, have given minimum test figures of 7.5 lb. steam per indicated horse-power hour. Yet lower figures than these are obtained by small marine compound engines of under 1 000 H. P.—as 5.5 to 6.5 lb.—so that actually the world's records for the most economical operation are still held by piston engines of the Hornblower or compound type running with « cut-offs » (or the steam admissions) at from 30 to 50 % of the piston stroke.

Reduction by condensing.

In stationary engines the condensing plant reduces the fuel consumption by 30 % with respect to non-condensing operation, and this reduction by condensing, if it were applicable to locomotives by some system as yet unemployed, would lower the steam consumption from the present 13 lb. to 9 lb. superheated steam per indicated horse-power hour. (The drop in the compound steam consumption of 19 lb., in the period 1895-1905, to 12-13 lb. in 1912-1914, was due to superheating and to improved valves.) At present, however, the general steam consumption per indicated horse-power hour, on fairly level railway lines which do not require a heavy drawbar pull after the train has started, is 23 lb. of high-pressure superheated steam at high pressure, in the best locomotives of the United Kingdom and of the United States, when using feed-heaters and the most improved forms of valve-gear and valve-settings in connection with single expansions. The rate of 21 lb., as already quoted, includes deductions for steam- and water-losses of every description. These best results apply to those « simple » locomotives

which during laboratory-bench tests, according to the worldwide publications made by the Altoona testing plant of the Pennsylvania Railway, can be made to show minima of so low as 16 lb. steam per indicated horse-power per hour, and so low as 10.5 lb. superheated steam per horse-power hour with double expansion of the steam when also tested in the same manner at Altoona. Such results, although so extensively published in American and British engineering journals, have, however, no practical relation to actual train working results. They merely show the locomotive, as a steam engine, tested under the ideal conditions which obtain in central-station plants and without reference to the unavoidable losses by transmission to the train head.

As in Stephenson's time.

In Britain and America the Stephenson locomotive as used by Stephenson, or as fitted with superheaters by Richard Trevithick, is still the same old instrument of a hundred years ago, despite the complication of numerous accessories and of many cylinder parts which have at least appeared to modernise it. Under the best general conditions it is stated to average 23 lb. of high-pressure, high-superheat, steam per indicated horse-power hour when assisted by all the most recent economising devices. This corresponds to 2.5 lb. coal when evaporating 9 lb. steam per lb. of its weight whilst actually moving. Allowing for stationary burning times the gross rate is 3 lb., although Professor Dalby, in his recent lecture before the Royal Society of Arts (see fig. 12, p. 7, *Modern Transport*, 13 August 1927), quotes the somewhat exaggerated rate of from 3 to 5 lb. against the British engine. At 3 lb. average, each ton of coal gives 746.6 H. P. hours, or 8 212 million indicated horse-power hours per annum (allowing that 11 million tons of coal are consumed for power on our railways), as compared with 12 300 millions of H. P. hours, as so easily realisable by simply utilising the present exhaust steam of locomotives in a second expansion.

Economies on the Continent.

To-day, in service on the Continent, there are locomotives which normally develop 3 000 H. P. on the same steam and fuel consumptions which, in this country and America, can never by any other means be made to indicate more than 2 000 H. P. Per ton-weight of locomotive, and per ton-weight of fuel consumed, these compound locomotives develop between 50 and 60 % greater power than is possible with any similar-capacity boilers in the best examples of British and American practice and of which there have been published records; and of these express compound steam locomotives there are several millions of horse-power aggregate in units that are 50 % more powerful, per unit and per ton of weight, than any at work in English-speaking countries. The question of high efficiency and fuel economy does not, in fact, concern this country at all, except when it is a matter of electrification, of turbine locomotives, or of internal combustion locomotives. Necessity has forced the Continental railways to use plain, simple locomotives consuming only 12.5 to 13.5 lb. of steam per indicated horse-power hour, or an overall gross consumption averaged, per H. P. train hour, of 14.5 to 15 lb. steam, and corresponding to a gross fuel consumption, including stand-bys, of 2 lb. of fuel (evaporating at the English rate of 8 lb. steam per lb. of coal) and equal to 1 120 horse-power hours per English ton, or at the rate of 12 330 million H. P. hours with 11 million tons of coal.

Utilising exhaust steam.

Thus, utilising the exhaust steam, the probable power increase is : 12 330 —

8 212 = 4 118 million H. P. hours. This power-increase, by over 50 %, is obtained by a process at once so simple that it is readily understood by any adult having no knowledge of steam-engines, because it is a purely geometrical one and is determined by a pressure-increase on the pistons of from 50 to 60 % greater than can by any means be obtained in any single expansion. To obtain the same piston-pressure which is commonly indicated by the use of a boiler of 170 lb. maximum steam pressure with a double expansion of the steam, British and American railways have now been led to adopt 250 lb. boiler pressure, which yields the same horse-power in single expansion than is indicated with double-expansion engines having only 160 to 170 lb. boiler pressure. This is clearly shown to us by the recording instrument, known as the pressure-indicator, which gives the mean effective pressures on the pistons and as determined by measurement of the « card » areas by the « planimeter ». At any rate of speed, and at any degree of steam admission to the cylinder, these instruments show, ocularly, that for any given boiler pressure, the effective tonnage on the pistons of a locomotive, when working by double expansion, is 50 to 60 % greater, and the tractive efforts correspondingly higher, than the maximum that is realisable with the Stephenson locomotive as still employed in Britain and America.

Boiler pressure.

It is from these diagrams that one can learn the elements of steam power on railways. Transport by railway primarily depends upon this mean pressure on the pistons, and the maximum mean effective pressure that can be indicated in British and American locomotives with superheated steam and with the maximum steam admission, or « cut-off », as when just starting a heavy train, is 85 % of the full boiler pressure; while it is 130 % of the boiler pressure, or over 50 % greater, in double expansion. This fact is very often concealed by means of a calculation which consists in dividing this « 130 % » by the ratio which the larger cylinder bears to the smaller one. Where this ratio is 1 : 2.5, the clerical process adopted is « 130 ÷ 2.5 = M.E.P. 52 % » of the boiler pressure. This is misleading, because, as no live steam is admitted to the large cylinders, the reference should invariably be made to those cylinders which absorb steam direct from the boiler, and by which a true description of the 50 % superior tractive effort of the double expansion engine, for a given steam consumption, becomes unavoidably evident.

Recent British locomotives.

In the case of the most recent Great Western Railway, and London Midland & Scottish Railway express locomotives, with boiler pressures of 250 lb., the mean effective pressure, in full gear at first starting, is $0.85 \times 250 = 212.5$ lb. per square inch of the high-pressure piston area. Consuming steam at the same rate, with the same cut-off, but in double expansion, the autographically steam-indicated M.E.P. is then $1.30 \times 250 = 325$ lb., per square inch of the high-pressure piston area. By this means the indicated tractive effort becomes 30 tons in double expansion for every 20 tons that are indicated in single expansion; but as there is no increase in the weight of the boiler, with the power as thus increased, it becomes necessary to augment the dead weight of the locomotive by means of extra metal in the cylinders or in other parts, in order to prevent the wheels from slipping when starting trains. As soon as the train is in motion the 50 % power-increase as realised by utilising the exhaust steam, continues constant up to 90 miles per hour, whatever be the

rate of steam cut-off. Tables of mean effective pressures, per pound of any given boiler pressure, are now available for draughtsmen and designers of locomotives, and these, based entirely on indicator diagrams made with superheated steam, show that the mean effective piston pressure is *constantly* about 53 % greater in double expansion than it is in single expansion, at all speeds, from 5 to 90 miles per hour, and with all degrees of cut-off of the steam into the cylinders. At first starting equally as at 90 miles per hour, the locomotive's pulling power is increased one half as much again when its exhaust steam is used to supplement the usual power; so that, where the maximum load for a given average express speed is now, say, 530 tons, it becomes 800 tons for double expansion, and without any increase in the consumption of steam, water or coal. Recent tests on the Paris, Lyons and Mediterranean Railway of France have shown that, with cut-offs averaging 45 %, with superheated steam at 170 lb. boiler pressure, and whilst ascending 82-mile grades, a record rate of 19 lb. steam per indicated horse-power hour was realised. This compares with a rate of 21 lb., with very short cut-offs, achieved by Great Western « Castle » class locomotives over a fairly level road, and in both instances with locomotives working by simple expansion. And yet there are engineers in this country and America who still argue that if simple cylinders were only made long enough, with cut-offs short enough and pressures high enough, the M.E.P. might be augmented by from 50 to 60 %. The fallacy of such arguments needs no further demonstation than that furnished on a scale of millions of horse power by European railways.

[625 .26 (.42)]

Progressive railway carriage lifting and repairing.

Figs. 1 to 6, pp. 1085 to 1090.

(The Railway Gazette.)

During the last decade the modern railway carriage has increased in dimensions, also numerically, while the shop accommodation has remained stationary; it has, therefore, become necessary that more modern methods should be employed so that general repairs could be dealt with in the prescribed periods, or that an increase in shop area and staff should be provided — a procedure which would involve a considerable amount of capital outlay. With this in view, a progressive lay-out, planned especially for the lifting and repairing of carriage stock, has been instituted at the Newton Heath Carriage and Wagon Works of the London Midland & Scottish Railway by Mr. E. J. H. Lemon, Carriage and Wagon Superintendent, under the direction of Mr. R. W. Reid, formerly Carriage and Wagon Superintendent and now Vice-President for Works and Ancillary Undertakings. The provision of extra accommodation at these works was impossible, and the scheme subsequently evolved enabled the floor space and plant available to be utilised much more economically than has been the case in the past.

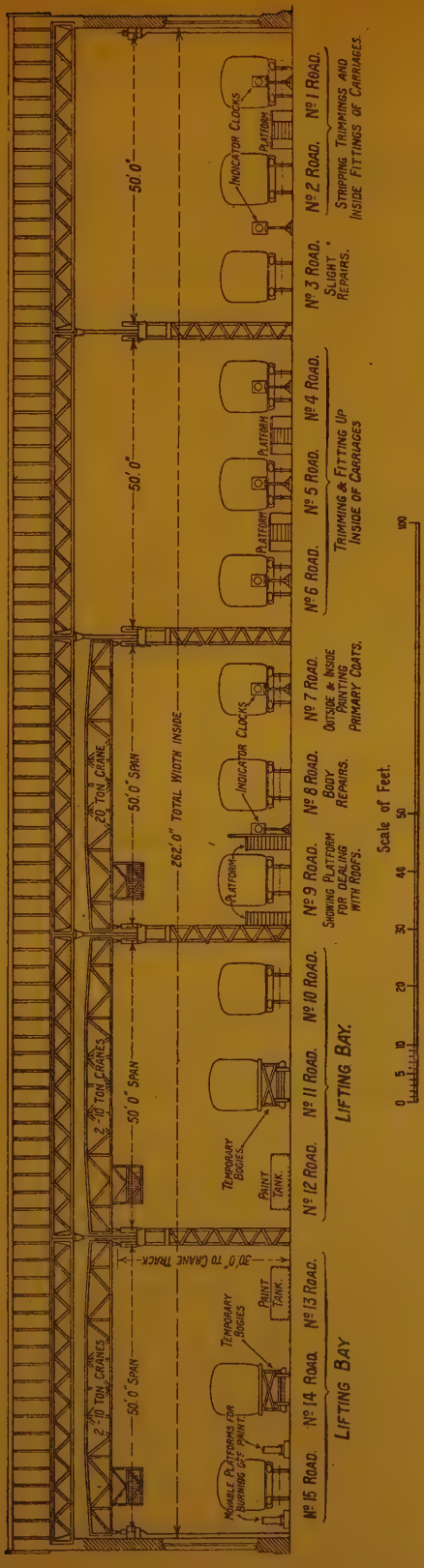


Fig. 1. — Cross section through carriage lifting and repair shop at Newton Heath, Manchester, London Midland & Scottish Railway.

To accomplish this object definite principles were laid down to be worked to, such as: 1. the elimination of man-handling of materials as far as possible; 2. moving the job to the man, and not the man to the job; 3. allocating definite work to a given position; 4. supply of materials to be anticipated; 5. allocation of men to specified operations; 6. first operation to balance with the last; 7. all movements after definite intervals of time; 8. constant supply of carriages for repairs; and 9. good lighting, heating and comfortable working.

This system differs from the old method, as it enables work to be carried on on all sections of the carriages simultaneously, thus speeding up the time the vehicles are in the works.

The new system detailed.

When first considering the proposed progressive carriage repair system, thought was given to the necessity of curtailing the amount of shunting required to reach the shops from the traffic sidings, and it was decided to utilise a shop built in 1914 having direct access to the sidings, besides being adjacent to the paint shop, both shops being provided with a large area of tracks leading direct to the shop doors. The area of the shop selected is 126 808 square feet, and consists of one main building 484 feet long by 262 feet wide, the height from the running roads to crane tracks being 30 feet. The roof is of the weaving shed pattern with north lights. It is heated by warm air from a Sturtevant Plenum heating and ventilating system, the cold air being passed over steam coils and heated, and distributed all over the shop by means of ducts. This air can be drawn back and passed out again if necessary; it can also be washed by means of the water service provided, which is generally done in warm weather to keep the shop cool. Figure 2 shows the general lay-out of the shop.

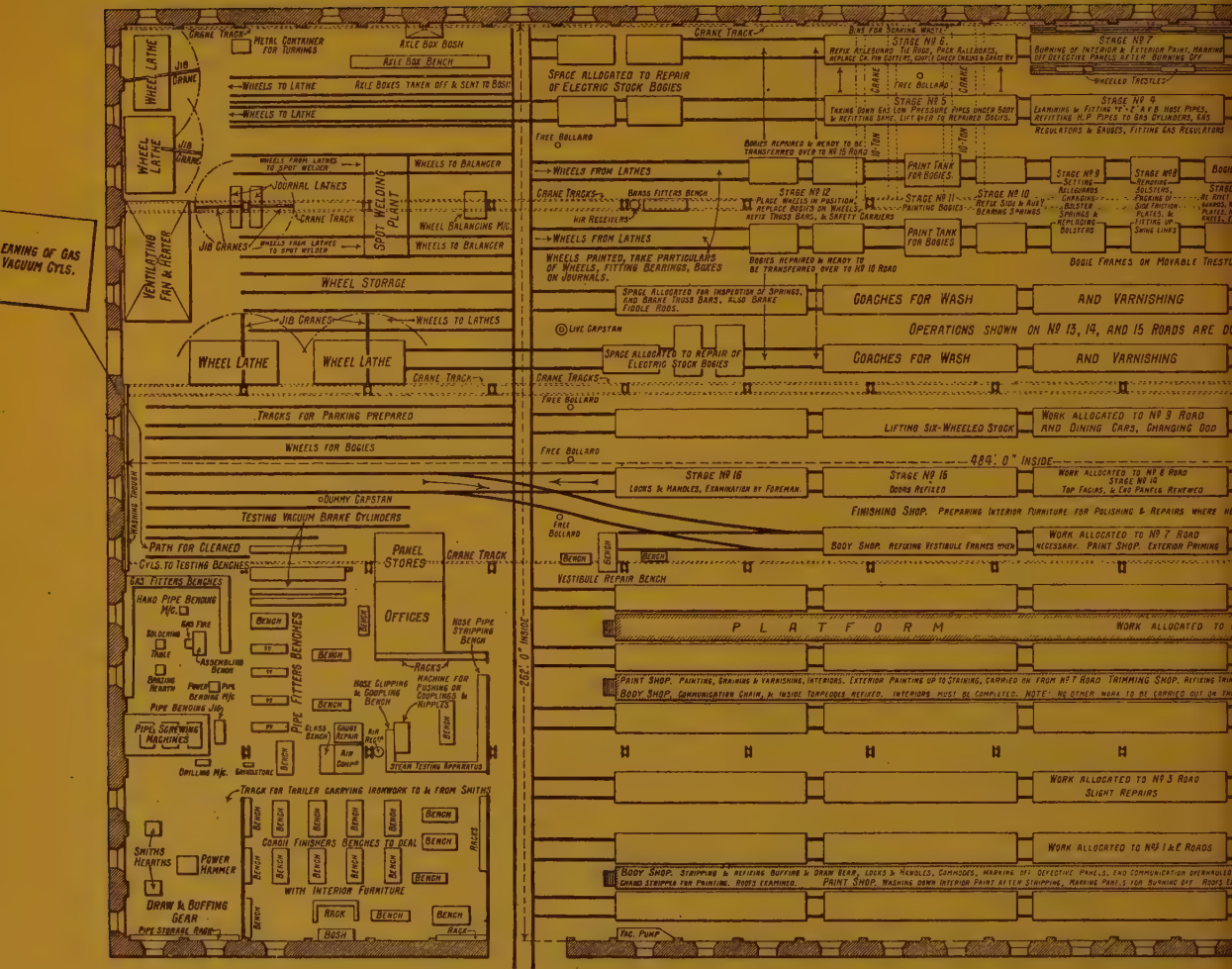
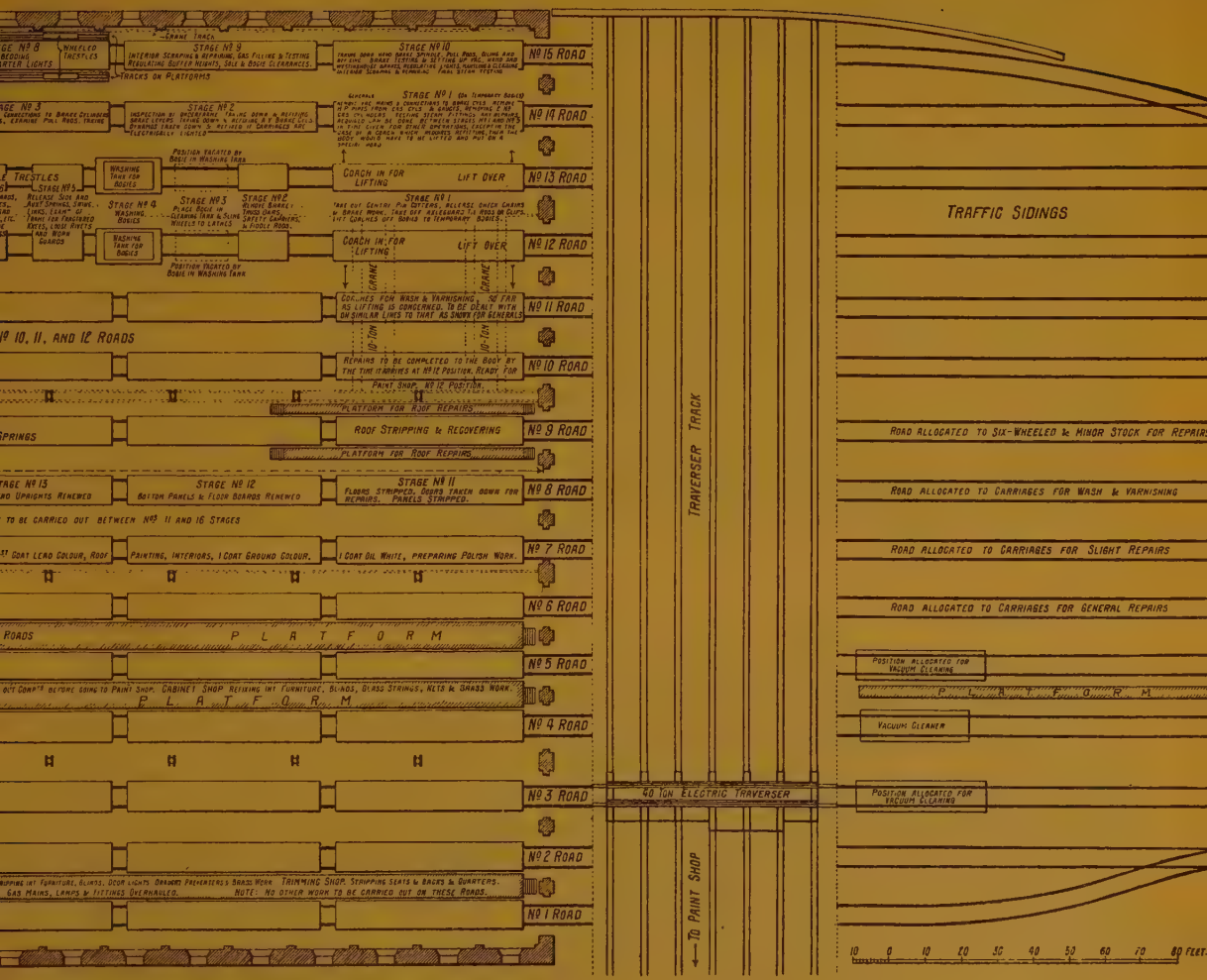

CRANE TRACK
METAL CONTAINER FOR TURNINGS
AXLE BOX BOSH
AXLE BOX BENCH
WHEEL LATHE
JIB CRANE
WHEELS TO LATHE
AXLE BOXES TAKEN OFF & SENT TO BOSH
WHEELS FROM LATHES TO SPOT WELDER
WHEELS TO BALANCER
JOURNAL LATHES
SPOT WELDING PLANT
WHEEL BALANCING MC.
VENTILATING FAN & HEATER
WHEEL STORAGE
WHEELS TO LATHES
TRACKS FOR PARKING PREPARED
WHEELS FOR BOGIES
DUMMY CAPSTAN
TESTING VACUUM BRAKE CYLINDERS
PATH FOR CLEANED CYLS. TO TESTING BENCHES
PANEL STORES
OFFICES
HOSE PIPE STRIPPING BENCH
GAS FITTERS BENCHES
HAND PIPE BENDING MC.
PIPE BENDING JIG
PIPE SCREWING MACHINES
PIPE FITTERS BENCHES
RACKS
HOSE CLIPPING & COUPLING BENCH
MACHINE FOR PUSHING ON COUPLINGS & NIPPLES
STEAM TESTING APPARATUS
TRACK FOR TRAILER CARRYING IRONWORK TO & FROM SMITHS
SMITHS HEARTHS
POWER HAMMER
DRAW & BUFFING GEAR
COACH FINISHERS BENCHES TO DEAL WITH INTERIOR FURNITURE
RACK
BOSH
252' 0" INSIDE
SPACE ALLOCATED TO REPAIR OF ELECTRIC STOCK BOGIES
STAGE № 6.
STAGE № 7
STAGE № 5
STAGE № 9
FREE BOLLARD
BOGIES REPAIRED & READY TO BE TRANSFERRED OVER TO № 15 ROAD
PAINT TANK FOR BOGIES
STAGE № 12
STAGE № 11
STAGE № 10
STAGE № 8
BRASS FITTERS BENCH
AIR RECEIVERS
WHEELS PAINTED, TAKE PARTICULARS OF WHEELS, FITTING BEARINGS, BOXES ON JOURNALS.
SPACE ALLOCATED FOR INSPECTION OF SPRINGS, AND BRAKE TRUSS BARS, ALSO BRAKE FIDDLE RODS.
LIVE CAPSTAN
COACHES FOR WASH AND VARNISHING
OPERATIONS SHOWN ON № 13, 14, AND 15 ROADS ARE D
LIFTING SIX-WHEELED STOCK
WORK ALLOCATED TO № 9 ROAD AND DINING CARS, CHANGING ODD
98' 0" INSIDE
STAGE № 16
STAGE № 15
STAGE № 14
FINISHING SHOP. PREPARING INTERIOR FURNITURE FOR POLISHING & REPAIRS WHERE
BODY SHOP. REFIXING VESTIBULE FRAMES WHEN
WORK ALLOCATED TO № 7 ROAD NECESSARY. PAINT SHOP. EXTERIOR PRIMING
VESTIBULE REPAIR BENCH
P L A T F O R M
WORK ALLOCATED TO
PAINT SHOP. PAINTING, GRAINING & VARNISHING, INTERIORS. EXTERIOR PAINTING UP TO STAINING, CARRIED ON FROM № 7 ROAD TRIMMING SHOP. REFIXING TRA
BODY SHOP. COMMUNICATION CHAIN, & INSIDE TORPEDOES REFIXED. INTERIORS MUST BE COMPLETED. NOTE: NO OTHER WORK TO BE CARRIED OUT ON TH
WORK ALLOCATED TO № 3 ROAD SLIGHT REPAIRS
WORK ALLOCATED TO № 1 & 2 ROADS
BODY SHOP. STRIPPING & REFIXING BUFFING & DRAW GEAR, LOCKS & HANDLES, CORNICES, MARKING OFF DEFECTIVE PANELS, END COMMUNICATION OVERHANGING CHAINS STRIPPED FOR PAINTING. ROOFS EXAMINED.
PAINT SHOP. WASHING DOWN INTERIOR PAINT AFTER STRIPPING, MARKING PANELS FOR BURNING OFF ROOFS
VAC. PUMP

Fig. 2. — General lay-out of carriage lifting and repair shop

The shop is divided up into five bays, and each bay contains three roads, the lifting bays being equipped with 10-ton cranes, two in each bay, and a 20-ton crane over roads Nos. 7, 8 and 9, this crane dealing with six-wheeled and minor stock on No. 9 road. Artificial lighting is carried out with gas-filled 1 500-watt, 200-volt lamps, so arranged as to give an even distribution of light over the whole area. One section at the end of the shop has been allocated for bench work to deal with the interior furniture of carriages and the repairing and testing of vacuum brake and steam-heating equipment. The shop is also provided with a pneumatic hammer and smiths' hearths for the re-conditioning of buffing and drawgear. A wheel plant (fig. 3) has been installed for turning up wheels, and consists of



n Heath, Manchester, London Midland & Scottish Railway.

four wheel lathes (two of which are equipped with grinding attachments), two journal lathes, wheel balancer, together with a spot welding apparatus. The shop is provided with boshes for dealing with the cleaning of axle-boxes, and also with an electric capstan, together with a number of free bollards on the various runs.

A new Ransome & Rapier 40-ton bogie carriage traverser has been introduced at the east end of the shop for drawing carriages in and out of the various runs, and also for traversing the vehicles to the paint shop for painting. Vacuum and steam testing, and also gas-equipment testing, can be carried out at any point. In the case of gas-lighted stock during the course of interior repairs, carriages are lit up by gas from their own cylinders, which obviates the necessity of men

having to procure a light to carry on their duties, and they are thereby enabled to proceed with their work without any inconvenience. In addition, the particular roads on which this work is carried out are also fitted with portable electric lamps at intervals along the staging.

The artificial lighting utilised for attending to the underframes, the taking down and putting up of brake cylinders, gas cylinders, and the electrical gear, as the case might be, whilst the carriages are on temporary trucks, is provided by means of flood lighting from electric lights suitably arranged in the floor in the centre of the track. By this means the light is thrown up and diffused underneath the underframe, thus obviating the necessity of men having to carry portable lamps.

Classifying repairs.

Under the new system the carriages are selected for various classes of repairs, such as: 1. general repairs, 2. wash and varnish, 3. lift and slight repairs, and 4. slight repairs only, and are received on the roads outside the shop at given periods during the week, each class being kept separate. They are then in such a position for the traverser to draw upon any class of repairs required. The advantage of this arrangement over the old system is that it is not possible to side-track a carriage, and the rule is that the first carriage placed on the road is the first to go into the shops and the first out.

There are 15 roads leading into the paint shop, and these are so arranged that as the painting of carriages is completed the vehicles are drawn out of the shop by the traverser and placed on to the sidings, where they receive the final inspection before running trial. After trial the carriages are placed into the traffic department sidings, which are adjacent to the works.

The time schedules.

The carriage repair shop consists of 15 roads 13 of which are used for the progressive system, and the remaining two for the lifting of six-wheeled stock, roofs stripping, and heavy damages. Eleven of these roads are capable of accommodating six bogie carriages on each road, and the remaining two roads are utilised for the repairing of bogie frames. A definite number of operations has been allocated to each road, and a time given to complete each operation. At the end of each track clocks have been provided to notify the men the time the next move will take place (as illustrated in fig. 4); immediately under the clock face is a printed notice detailing the work which has been allocated to the particular stages, and no work is allowed to be carried out at any other point than at the stage allocated for it. For instance, Nos. 1 and 2 roads are allocated to the stripping of interiors, such as furniture, trimmings, brasswork, outside door locks, and handles and commodes; roofs are examined, gas fittings overhauled, buffing and drawgear changed.

Organisation.

Every facility has been made for the free and-easy movement of the men on the job, and for this purpose a platform, the height of the compartment floors, has been run the full length of the two roads, the width being such that it enables a man to walk from one compartment to another on the adjacent road. On either side of the platform electrical portable connections are fitted with an independent switch to each light, so arranged to cover two compartments per light. When the lights are not in use the lamps are placed inside a metal container fitted to the underside of the platform, a portion of the floor being hinged to form a door of the container, making it easy for the operator to manipulate, and saving time. Although two roads have

Fig. 3. — Wheel-turning plant.

Fig. 4. — View across shop, showing time indication and work allocation boards.

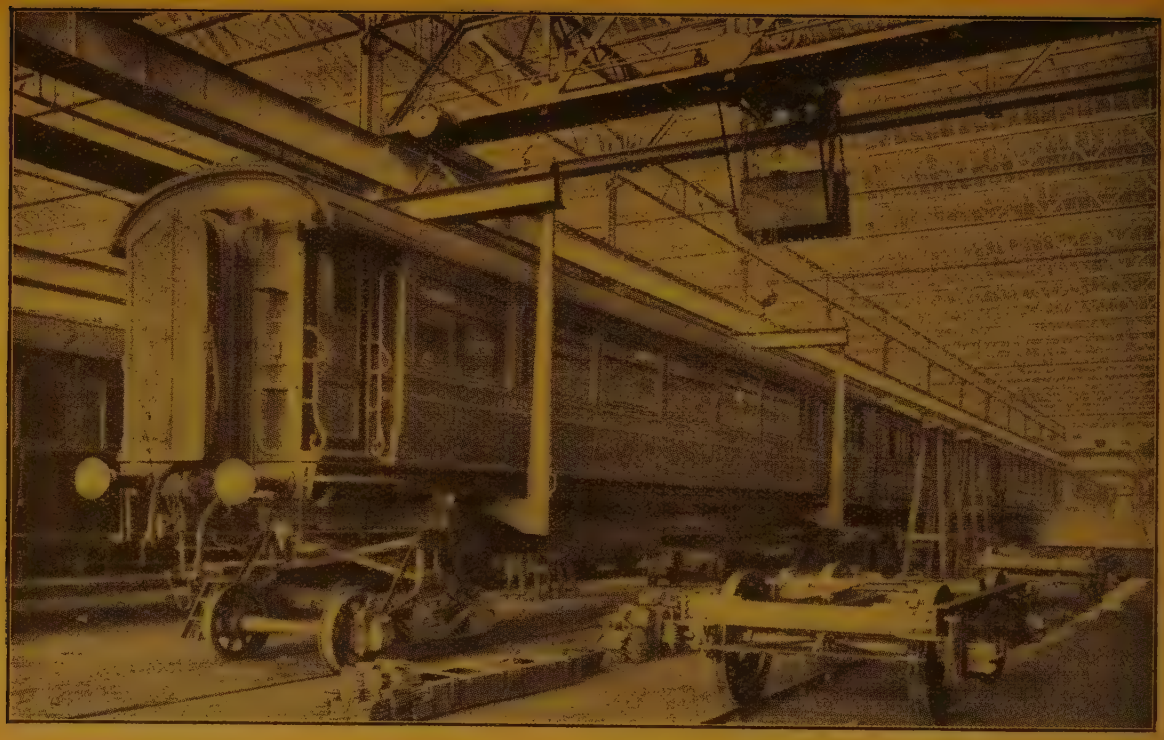


Fig. 5. — Carriage being lifted on to temporary bogies.

Fig. 6. — View of finishing roads Nos. 4, 5 and 6.

been allocated for this work, the men actually work on one road at a time, and as soon as they have completed No. 1 road another lot of carriages are waiting for them on No. 2 road. The carriages on No. 1 road are then ready for the lifting roads, and by the time these are drawn off for lifting and replaced with six more carriages, those standing on No. 2 road have been stripped, the men transferring back to No. 1 road, the next movement to the lifting runs being from No. 2 road.

The transporting of the material stripped from the coaches is done by labourers, thus enabling the skilled artisan to remain at his allotted position. The two lifting bays, roads Nos. 10 to 15 inclusive, are each fitted with two 10-ton cranes and lifting beams, the same operation being carried out in both bays. One road in each bay is used for cleaning, repairing and painting bogie frames, the second run for overhauling brakework, changing vacuum and gas cylinders, repairs and examination to underframe, steam mains, etc. The third run is the return road after lifting, and various operations are carried out on this road. In commencing the lifting operations the carriages are placed on one road where the centre cotter pins are removed and check chains, brake work and axleguard tie rods released. The carriages when lifted from the bogies are placed on temporary bogies on the adjacent road, as illustrated in figure 5. The temporary bogies are so designed that a man can stand upright to carry out any repairs on the underframes. The bogies, after the carriage body is lifted off, are pushed forward, and the brass bars, safety carriers and brake fiddle rods removed. The frame is lifted off its wheels, picked up by the crane and lowered into a tank filled with a cleaning solution. Steam pipes are run round this tank, and a number of agitators fitted, about 2 feet apart, inside the tank. The cleaning solution is heated up to 200° Fahr., and the bogie immersed for 50 minutes, when it is lifted out and placed on small mobile trestles preparatory to repairing.

Work allocations.

There are six positions allocated between the cleaning tank and the paint tank at the opposite end of the road, each of which is so balanced as to come within a 50-minute move, and as soon as the time is due to lift a bogie frame out of the washing tank the whole sequence moves up one stage. The bogies, after being dipped in the paint tank, are placed on the wheels and the brakework coupled up, and then transferred over to the road where they are paired ready for receiving the carriages. The vehicle on the adjacent road is then lifted on to the repaired bogies and the brakework coupled up, the carriage afterwards moving on to another position. As the bogie frames move forward every 50 minutes the carriages on the adjacent road move forward every 100 minutes.

The wheels and axle-boxes are taken by crane and transferred to the opposite end of the bay where the axle-boxes are removed, cleaned and refitted, and the wheels passed forward to the wheel lathes for turning, afterwards to the journal lathe, spot welder, and finally to the wheel balancer, returning to meet the repaired bogies. The output from the lifting bays is equal to 10 bogie coaches per day, or one carriage every 52 minutes. The carriages, after being lifted, return on Nos. 10 and 15 roads respectively, on which the burning-off of interior and exterior paint, bedding quarterlights, regulating and final testing of brake, gas and steam fittings, are carried out. The carriages that are passing through the shop under the term « wash and varnish » go from this position to the paint shop, but the carriages that are undergoing general repairs are transferred to No. 8 road, where the speed of movement is 3 hours

SUMMARY OF WORK DONE AT THE VARIOUS STAGES.

Nos. 1 and 2 ROADS.

Body shop.	Cabinet shop.	Trimming shop.	Paint shop.	Gas and pipe shop.
Stripping and refixing buffing and drawgear, locks and handles, commodes, marking off defective panels. End communication overhauled and chains stripped for painting.	Stripping interior furniture, blinds, door lights, draught preventers and brasswork.	Stripping seats, backs and quarters. Roofs examined.	Washing down interior paint after stripping, marking panels for burning off. Roof examined.	Gas mains, lamps and fittings overhauled.

No. 14 ROAD.

Stage No. 1.	Stage No. 2.	Stage No. 3.	Stage No. 4.	Stage No. 5.
Remove vacuum mains and connections to brake cylinders, remove high-pressure pipes from gas cylinders and gauges. Removing No. 2 gas cylinders. Testing steam fittings. Any repairs required can be done between stages Nos. 1 and 5 in time given for other operations, except in the case of a coach which requires refitting. Then the body will have to be lifted and put on a special road.	Taking down and refixing brake levers. Taking down A.V.B. cylinders and refixing. Dynamos taken down and refixed if carriages are electrically lighted. Inspection of underframes.	Refitting vacuum mains and connections to brake cylinders, refixing gas cylinders, examine pull rods, taking down and refixing.	Examining and fitting 1/2-inch and 2-inch A. V. B. hose pipes, refitting high-pressure pipes to gas cylinders, gas regulators and gauges. Fitting gas regulators.	Taking down gas low-pressure pipes under body and refitting same. Lift over to repaired bogies.

No. 15 ROAD.

Stage No. 6.	Stage No. 7.	Stage No. 8.	Stage No. 9.	Stage No. 10.
Refix axleguard tie rods, pack axle-boxes, replace centre pin cotters, couple check chains and brakework.	Burning off interior and exterior paint, marking off defective panels after burning off.	Rebedding quarter lights.	Interior scraping and repairing, gas filling and testing. Regulating buffer heights, sole and bogie clearances.	Taking down hand-brake spindle and pull rods. Oiling and refixing, brake testing and setting up vacuum, hand and Westinghouse brakes. Regulating lights, mantling and cleaning, interior scraping and repairing. Final steam testing.

No. 8 ROAD.

Stage No. 11.	Stage No. 12.	Stage No. 13.	Stage No. 14.	Stage No. 15.	Stage No. 16.
Floors stripped, doors taken down for repairs, [illegible] stripped.	Bottom panels and floor boards renewed.	Waist panels and uprights renewed.	Top fascias and end panels renewed.	Doors refixed.	Locks and handles examination by foreman.

Body shop.	Paint shop.
Refixing vestibule frames when necessary.	Exterior priming coat and stopping first coat lead colour, roof painting interiors, one coat ground colour, one coat oil white, preparing polish work.

Nos. 4, 5 and 6 ROADS.

Paint shop.	Trimming shop.	Cabinet shop.	Body shop.
Painting, graining and varnishing interiors. Exterior painting up to staining carried on from No. 7 road.	Refixing trimmings and lino. Cleaning out compartments before going to paint shop.	Refixing interior furniture, blinds, glass strings, nets and brasswork.	Communication chain and inside torpedoes refixed. Interiors must be completed.

No. 3 ROAD.

Allocated to slight repairs.

Operations shown on 13, 14 and 15 roads are duplicated on roads Nos. 10, 11 and 12 for coaches for wash and varnishing.

No. 9 ROAD.

Work allocated to lifting six-wheeled stock, dining cars, minor stock, changing wheels and springs.

Roof stripping and recovering.

No. 13 ROAD.

Stage No. 1.	Stage No. 2.	Stage No. 3.	Stage No. 4.	Stage No. 5.	Stage No. 6.
Take out centre pin cotters, release check chains and brakework, take off axleguard tie rods or clips preparatory to lifting over to No. 14 road.	Remove brake truss bars, safety carriers, and fiddle rods.	Place bogie in cleaning tank and sling wheels to lathes.	Washing tank.	Release side and auxiliary springs, swing links. Examination of frame for fractured knees, loose rivets and worn guards.	Cut off axle guards, wearing plates, headstocks and defective knees, etc. Take down side bearings prings.

Stage No. 7.	Stage No. 8.	Stage No. 9.	Stage No. 10.	Stage No. 11.	Stage No. 12.
Re-rivet axleguards, wearing plates, headstocks, and knee.	Removing bolsters, packing of side friction plates, and fitting up swing links.	Setting axleguards, changing bolster springs and replacing bolsters.	Refix side and auxiliary bearing springs.	Paint tank.	Place wheels in position, replace bogies on wheels, refix truss bars and safety carriers.

20 minutes, six positions being allocated for the completion of body repairs. The carriages return on No. 7 road, where painting up to the filling coats and polishing of interior furniture are carried out. The carriages are afterwards transferred to the finishing road, three of which are allocated for this purpose. This enables a continual flow of carriages on Nos 7 and 8 roads at regular intervals of 3 hours 20 minutes.

The finishing roads Nos. 4, 5 and 6, shown in figure 6, are fitted with platforms similar to Nos. 1 and 2 roads; the interiors of the carriages are entirely finished and exterior painting up to the rubbing down stage, prior to being handed over to the paint shop, is carried out. The operations are so arranged that when No. 7 road has been filled up with carriages from No. 8 road, the carriages on Nos. 4, 5 and 6 roads are transferred alternately to the paint shop and replaced with coaches from No. 7 road, which takes place every two days.

Synopsis of operations.

The accompanying table is a synopsis of the operations carried out at the various stages throughout the shop prior to the carriages being transferred to the paint shop for completion of painting. The time allowed in the paint shop for the finishing coats of paint is nine days.

Economies effected by the system.

Under the progressive system of repairs the time taken for general repairs to bogie coaches from selection until they are handed to the traffic department is 25 working days, as compared with 59 working days under the old practice. The carriages for wash and varnish now occupy 16 working days as compared with 37 working days under the old method.

It will be seen that quite apart from the carriages being out of traffic for a less period it leads to an increased earning capacity for each vehicle. The chief advantages obtained from this progressive system of repairs are : 1. increased output at reduced costs for the same working hours; 2. less amount of floor space occupied; and 3. improved conditions for the employees engaged on this work.

The system has been working now for the last seven months, and the output of bogie carriage repairs has been increased from 30 to 53 per week with the same staff.

[656 .254 (73)]

New York Central installs first complete train dispatching system,

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Fig. 1 to 13, pp. 1096 to 1103.

(*Railway Age.*)

On 25 July 1927, a 40-mile heavy traffic section of road, consisting of 37 miles of single track and 3 miles of double track, between Toledo, Ohio, and Berwick on the Ohio Central Lines of the New York Central was placed under the direct control of a dispatcher who directs train movements entirely by signal indication.

The new signal system supersedes the timetable and train order system which, with manual blocking, was in use. In this application it differs radically from the general practice in which a signal system is used merely for blocking, supplementing the timetable and train order system. Through a dispatching machine located at Fostoria, Ohio, the dispatcher operates the siding and crossover switches and the block signals along the line, and receives complete information as to the location of all trains. Written train orders and rights by class and direction are abolished. One train has no official knowledge of the presence of other trains on the road, but the dispatcher establishes meeting and passing points as the immediate conditions require. The normal traffic includes 12 fast and two local passenger trains and about 20 tonnage freight trains, including two local freights, per day.

This installation is believed to be the first and only system complete in every respect for the dispatching of trains by signal indication. The system was designed and installed by the General Railway Signal Company, Rochester, N. Y., under the direction of Sedgwick W. Wight, commercial engineer for the signal company, and the writer.

Block signals and power switches.

Block signals of the color-light type are located as shown in a typical section illustrated by figure 2. The double track is signaled for the movement of traffic in either direction on both tracks, the absolute-permissive block (APB) plan of automatic control being used on double as well as single track. This control automatically prevents opposing train movements from siding to siding or from crossover to crossover and permits trains to follow each other from signal to signal. In addition to the automatic control, the signals at the ends of sidings and crossover switches are subject to the control of the dispatcher. The switch machine and signals at the end of each siding or at the end of each crossover constitute a controlled group which is virtually a small interlocking plant controlled by a single lever in the dispatching machine. All opposing signals of each group are electrically interlocked against each other and the opposing signals of one group are electrically interlocked against the opposing signals of an adjacent group. Signal controls are selected through the switch machines so that switches must be in proper position before a proceed signal indication can be displayed. In other words, the controls are self-checking and the dispatcher, in controlling these groups, is only able to permit train movements to be made if conditions on the roadway are safe.

The installation includes 20 single-switch controlled groups, counting the double track connections and 6 crossover controlled groups on the double track line, making a total of 26 groups operated by 26 levers in the Fostoria dispatching machine.

Control from Fostoria.

The dispatching tower is a two story brick structure with basement, electrically lighted, with steam heat and modern plumbing. Figure 1 is an interior view on the second floor, showing the dispatcher at work in front of the dispatching machine. The close-up view of a section of the machine shows five features of importance, namely :

« 1. The *automatic recorder*, which is located on top of the dispatching cabinet and produces a graphic record of the movement of trains.

« 2. The *track diagram*, which visualizes for the dispatcher the entire territory, the location of trains and the position of the power-operated switches.

« 3. The *light indicators*, which show

the dispatcher what is taking place on the line and the direction of traffic.

« 4. The *control levers*, which operate the switches and signals, one being required for each controlled layout. They also operate the miniature switches on the track diagram.

« 5. The *key switch*, located directly under the control lever, which is used to cut out the audible signal to an « OS » indication and also to prevent a signal from clearing the second time automatically if the dispatcher should wish to hold a following train.

Fig. 1. — Dispatching machine at Fostoria, Ohio, on the Ohio division, New York Central Lines.

The manipulation of the dispatching machine.

The dispatching machine automatically places before the dispatcher information as to the location of trains and gives him the means of controlling the movement of each train. Other information as to train delays or the movement of local or work trains, or trains about to enter the controlled territory is brought in through the telephone system.

The control levers are arranged in a horizontal row and operate in three positions : central, upward and downward. These positions control the roadway equipment as follows :

« A lever in the central position causes the signals in the respective controlled group to assume the stop position, and the switch to remain in the position to which it was last operated.

« A lever in the upward position causes the switch to move to the position for the diverging route (if not already in that position) and permits the corresponding signals to give proceed or caution indications, if the respective blocks are not obstructed.

« A lever in the downward position

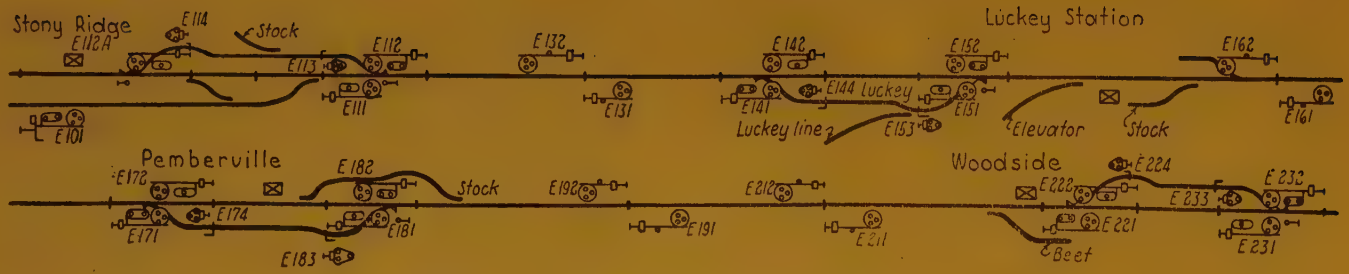


Fig. 2. — Typical section showing signal arrangement.

Fig. 3. — Controlled siding location.

Fig. 4. — Double track crossover location.

causes the switch to move to the position for the main track route (if not already in that position) and permits the corresponding signals to give proceed or caution indications, if the respective blocks are not obstructed. »

Trains are represented by plugs which carry removable cards on which are indicated the train numbers and direction of movement. The plugs, called train tokens, are inserted in jacks or holes located along the track diagram. The train tokens are moved by the dispatcher as he receives information from the roadside by means of the light indicators which are located directly below each passing track switch on the control board and are known as « OS » indicators. An indicator lights when a train passes onto a short track section in which the passing track switch or crossover is located and remains lighted until the train clears this track section, provided the control lever is left either upward or downward.

The « OS » indicator also informs the dispatcher when the switch responds to the lever movement by giving a brief but distinct flash when the switch points open and by flashing again when the switch points close. To call the dispatcher's attention to something having happened which may require action on his part, a single stroke bell sounds whenever an « OS » indicator lights.

Key switches, located directly under the control levers, are used for two purposes : First, when thrown downward, a key switch cuts out the audible signal of the « OS » indicator above the lever; second, when thrown upward a key switch transforms the roadside signal into a « stick » signal and the « OS » indicator will remain lighted after the train has passed off of the track circuit, and until either the control lever is restored to the central position or the key switch is put back. By « stick » signal is meant a signal which will not clear after being put to stop by a train until the control lever is again operated. This « stick » feature is of value when the dispatcher wishes to let one train pass and stop a second train without further attention on his part; or when he is away from his desk for a period and wishes to pick up the location of trains quickly on his return.

Explanation of operation for a meet.

Figures 7 to 12 inclusive show the manipulation of the dispatching machine and what takes place on the line as two trains approach and leave their meeting point.

« Figure 7 shows train No. 2 on the main line between siding switches at Stony Ridge, train token 2 is similarly located on the track model, lever 6 is down and lever 7 up and the signals are clear for a movement of train No. 2 into the siding at Luckey. Figure 7 also shows train No. 3 on the siding at Pemberville.

« The dispatcher next operates lever 9 upward and lever 8 downward which lines up the switch at Pemberville and clears the signals for the movement of train No. 3 to Luckey, as shown in figure 8. In the meantime, train No. 2 is leaving Stony Ridge, the dispatcher being informed of this by the illumination of the « OS » indicator above lever 6.

« The « OS » indicator above lever 6 then goes dark indicating that train No. 2 has left Stony Ridge. He then advances token 2 to a location near the point from which he will receive his next « OS » from this train and restores lever 6 to normal, as shown in figure 9. Train No 3. is leaving Pemberville, as shown by the « OS » indicator above lever 9.

« When the « OS » indicator 9 goes dark, indicating that train No. 3 has cleared the siding at Pemberville, the dispatcher advances token 3 and restores lever 9 to normal, as shown by figure 10. Train No. 2 is now pulling into the sid-

ing at Luckey, as shown by « OS » indicator 7.

« Train No. 2 is in the clear at Luckey, the dispatcher operates lever 7 downward and lever 6 downward, which lines up the route for the movement of train No. 3 to Stony Ridge, as shown in figure 11. « OS » indicator 8 is now illuminated, which indicates the arrival of train No. 3 at Luckey. When « OS » indicator 8 goes dark, the dispatcher advances token 3, moves lever 8 upward and lever 9 downward which lines up the route for the movement of train No. 2 from the siding at Luckey to Pemberville. »

Special features for checking.

If two trains had been moving in the same direction between Stone Ridge and Luckey at the same time, the token for the first one would have been located, as shown in figure 9, and that for the second train in the next jack to the left.

As the opposing signals are interlocked against each other, the direction in which traffic can move is dependent upon the sequence of lever movements. For instance, when the dispatcher operated lever 6 and then lever 7, all signals cleared for a movement of train No. 2 from Stony Ridge to Luckey, as shown in figure 7. After train No. 2 had moved into the siding at Luckey, he operated lever 7 and then lever 6, which cleared all signals for a movement of train No. 3 from Luckey to Stony Ridge, as shown in figure 11.

In order that the dispatcher may know at all times the direction of traffic set up between any two adjacent controlled groups, direction indicators are provided. With the route set up for a movement from Stony Ridge to Luckey the top indicator between levers 6 and 7 displays an illuminated arrow pointing to the right, as shown in figure 7. With the route set up for a movement in the reverse direction, the bottom indicator displays an arrow pointing to the left, as shown in figure 11.

Another bit of helpful information for the dispatcher is given by the movable switch points on the track model which move when the control levers are moved to the upward or downward positions but do not move when the control levers are returned to the central positions so that the last position to which any switch has been operated is always indicated.

It should be noted that the dispatcher is unable to create an unsafe condition by the wrong manipulation of levers. He is only able to permit train movements to be made, provided conditions on the line are safe. In other words, each signal has a triple control, namely : 1. Automatic control, 2. Switch control — switches must be in proper position before the signal indication can be displayed, and 3. Manual control — consent of dispatcher must be secured. The graphic train sheet automatically produced by the recorder, keeps before him a record of elapsed time of each train between adjacent « OS » points. Train numbers shown on the graphic sheet are written in by the dispatcher as the graphs are being made and serve as quick identifications.

It will, therefore, be seen that the dispatcher, by observing the information automatically placed before him and by operating these control levers, controls the movement of trains within his territory, and establishes his meeting and passing points accurately, with the result that trains are run over his district in much less time than under the former system employing written train orders. Many interesting comparisons are occurring daily, one of which is cited here : Freight train No. 94 left Toledo at 9.30 p.m. 25 July, and the engine was not shut off until it arrived at Fostoria, taking siding for two meets and all trains keeping moving while making these meets. As a result of this prompt movement of No. 94, the crew was turned at

Bucyrus for a return trip to Toledo, the loop mileage being 134.

It is recognized that a remotely controlled power-operated switch is not well adapted to the switching of cars unless some convenient means of hand operation is provided. It is too slow for this kind of work and it is also difficult, if not impossible, to know when the switch should be thrown. The G. R. S. dual-control selector overcomes this difficulty by making it possible for the train crew, under prescribed rules, to operate switches by hand when switching is to be done. All of the 32 power-operated switches from Stony Ridge to Berwick are so equipped. A switch lamp with day disks mounted on the target stand is used at each dual control switch, although the lamp is lighted only when a

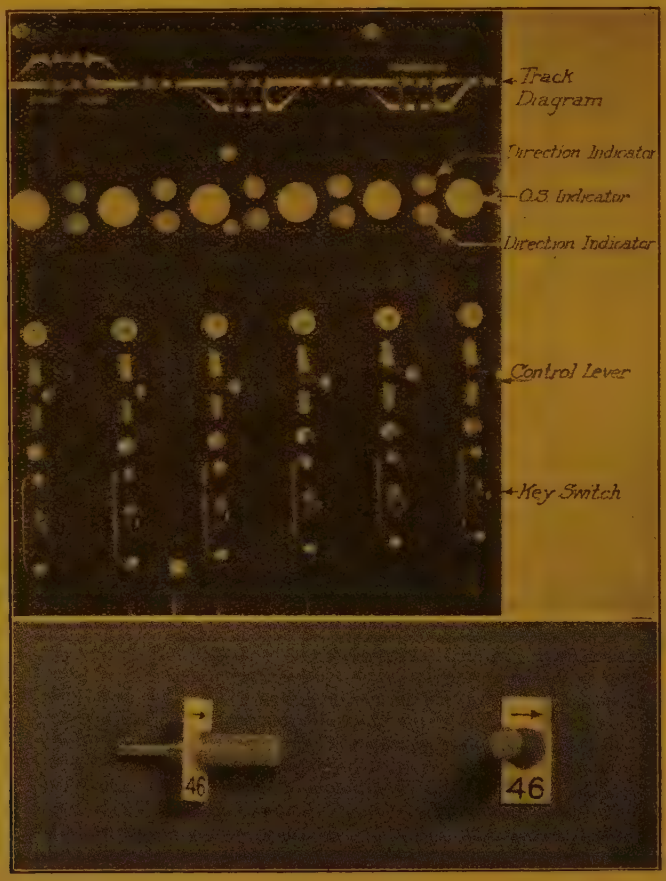


Fig. 5 (*above*). — Close-up of a section of control panel on dispatching machine.
Fig. 6 (*below*). — Train token for track diagram.

Figs. 5 and 6.

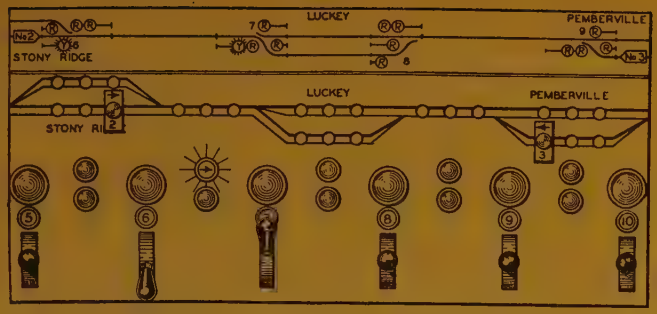


Fig. 7. — Route clear for train 2 to move from Stony Ridge to Luckey. Train 3 on siding at Pemberville.

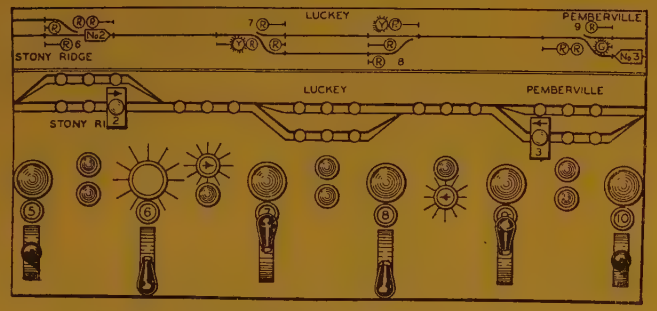


Fig. 8. — Train 2 leaving Stony Ridge and route is clear for train 3 to move to Luckey.

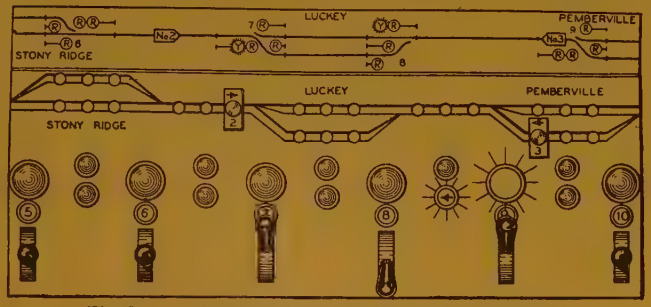


Fig. 9. — Train 2 has not arrived at Luckey and train 3 is leaving Pemberville.

Figs. 7 to 9. — Illustrating train movements for a meet.

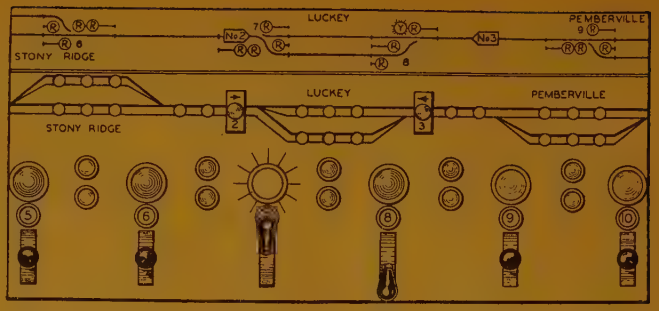


Fig. 10. — Train 2 is pulling into siding at Luckey and train 3 has passed beyond siding limits at Pemberville.

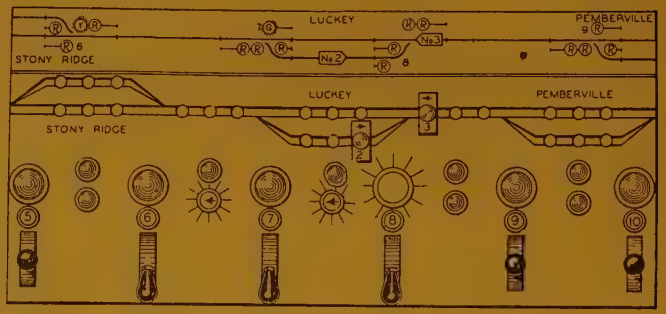


Fig. 11. — Train 2 is in the clear at Luckey and train 3 is arriving at Luckey with route clear for movement to Stony Ridge.

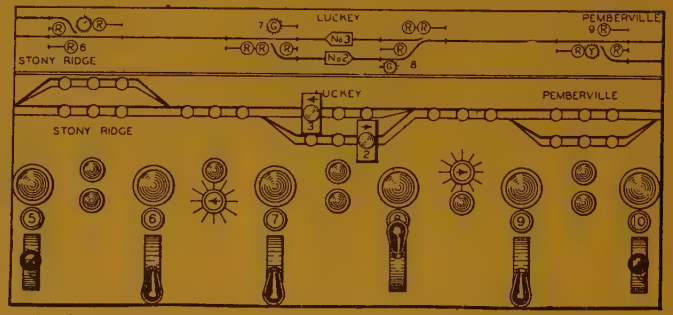
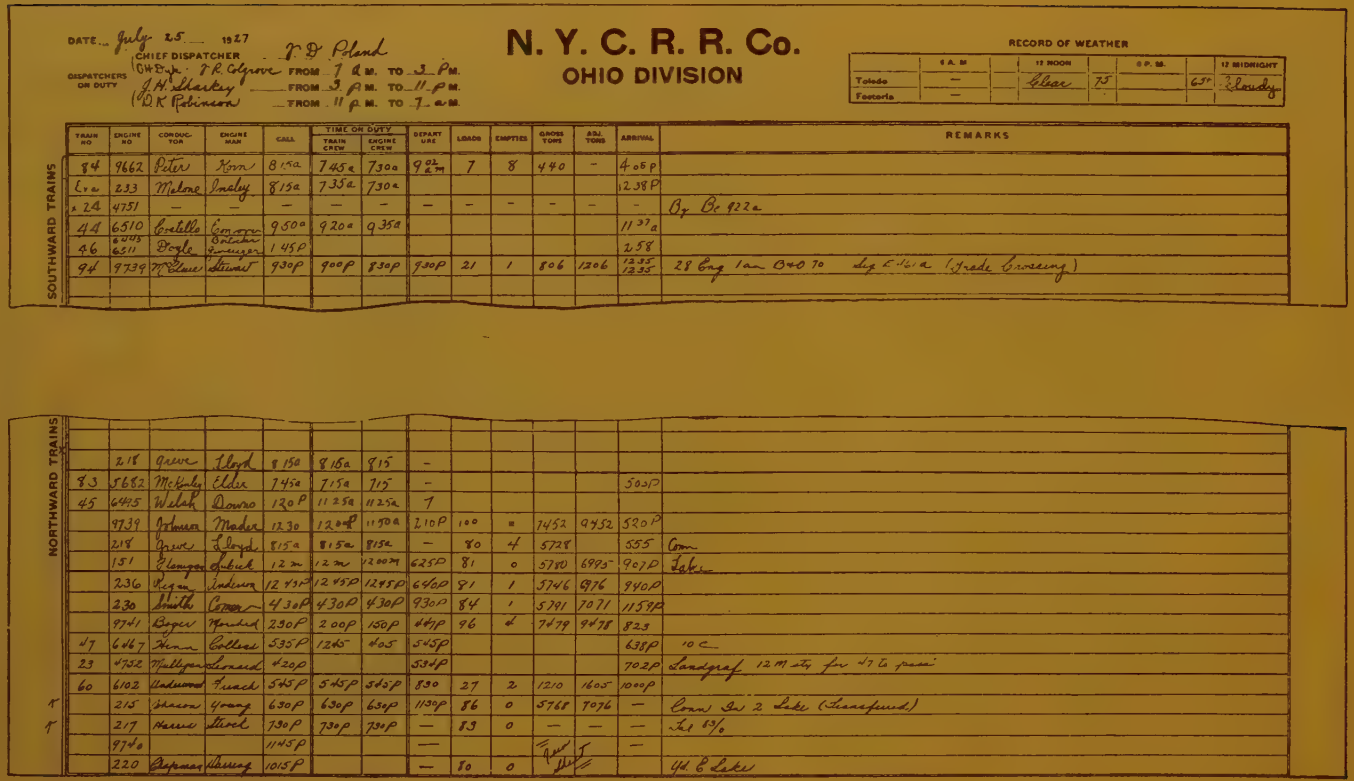


Fig. 12. — Train 3 has passed within siding limits at Luckey and route is clear for the movement of train 2 to Pemberville.

Figs. 10 to 12. — Illustrating typical train movement

Fig. 13. — Section of graphic train sheet, with heading, for 25 July 1927.



DATE July 25 1927

CHIEF DISPATCHER T D Poland

DISPATCHERS ON DUTY (CH Boyle T R Gilgrove FROM 7 A.M. TO 3 P.M.
J H Mackey FROM 3 P.M. TO 11 P.M.
D K Robinson FROM 11 P.M. TO 7 A.M.

N. Y. C. R. R. Co.
OHIO DIVISION

RECORD OF WEATHER

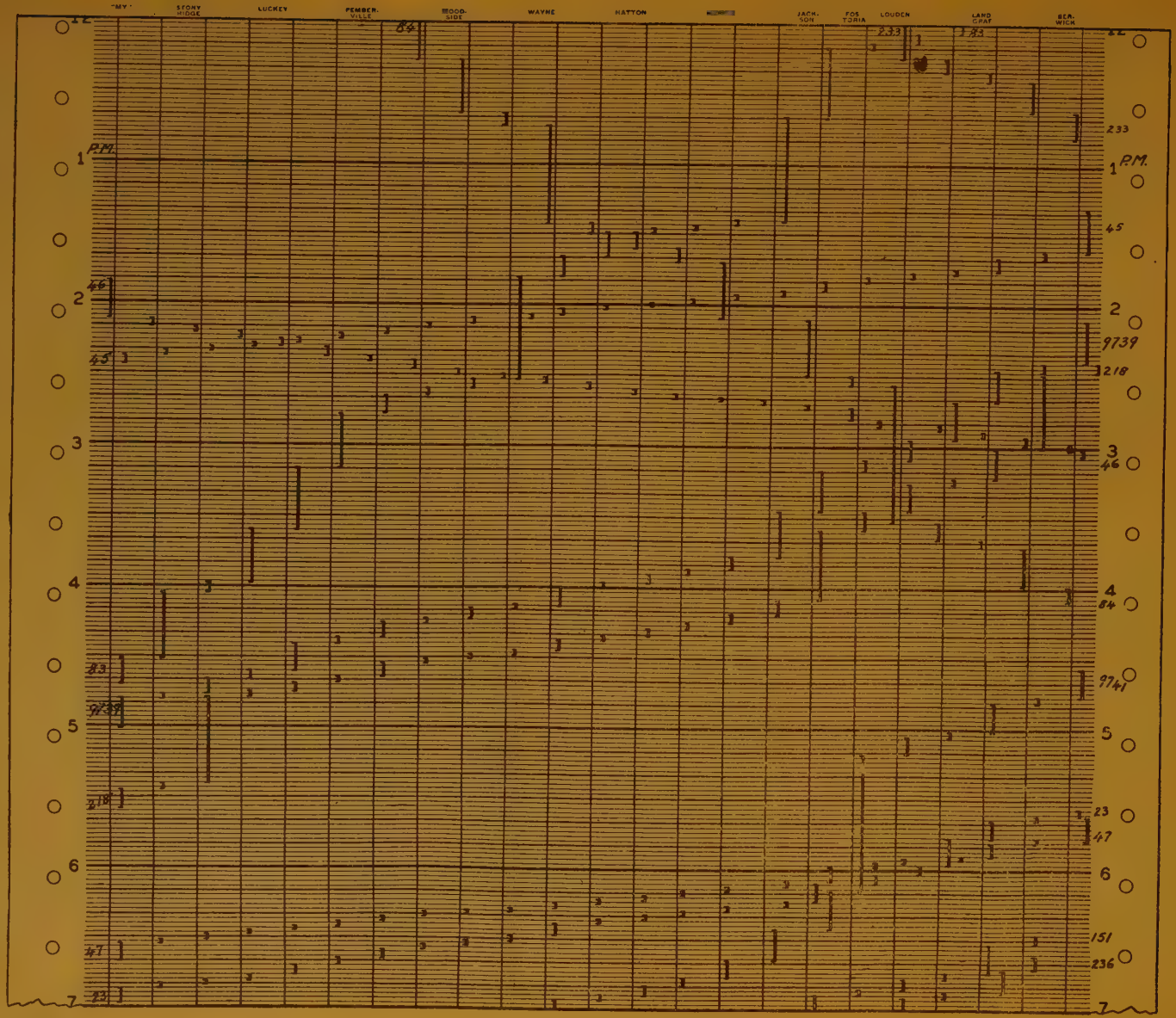
	6 A. M.		12 NOON		6 P. M.		12 MIDNIGHT
Toledo	—		Clear	75°		65°	Cloudy
Fostoria	—						

SOUTHWARD TRAINS

TRAIN NO	ENGINE NO	CONDUCTOR	ENGINE MAN	CALL	TIME ON DUTY: TRAIN CREW	TIME ON DUTY: ENGINE CREW	DEPARTURE	LOADS	EMPTIES	GROSS TONS	ADJ. TONS	ARRIVAL	REMARKS
84	9662	Peter	Korn	815a	745a	730a	922m	7	8	440	–	405p	
Lva	233	Malone	Imaley	815a	735a	730a						1238p	
x 24	4751	—	—	—	—	—	—	—	—	—	—	–	By Bc 922a
44	6510	Costello	Conroy	950a	920a	935a						1137a	
46	6511	Doyle	Schleicher Krueger	145p								258	
94	9739	McClure	Stewart	930p	900p	830p	930p	21	1	806	1206	1235 1235	28 Eng 1 am B+O To Lay Fitch'a (Grade Crossing)

NORTHWARD TRAINS

	218	Grove	Lloyd	815a	815a	815	–						
83	5682	McKinley	Elder	745a	715a	715	–					503p	
45	6445	Welsh	Downo	120p	1125a	1125a	7						
	9739	Johnson	Meader	1230	1200p	1150a	210p	100	11	7452	9452	520p	
	218	Grove	Lloyd	815a	815a	815a	–	80	4	5728		555	Conn
	151	Flanigan	Lubeck	12m	12m	1200m	625p	81	0	5780	6985	907p	Lake
	236	Regan	Indiana	1245p	1245p	1245p	640p	81	1	5746	6976	840p	
	230	Smith	Conner	430p	430p	430p	930p	84	1	5791	7071	1159p	
	9741	Boger	Mendel	200p	200p	150p	644p	96	2	7479	9478	823	
47	6467	Hann	Collins	535p	1245	605	545p					638p	10 C
23	4732	Mulligan	Leonard	620p			538p					702p	Landgraf 12 M sty for 47 to pass
60	6102	Underwood	Frank	545p	545p	545p	830	27	2	1210	1605	1000p	
	215	Hanson	Young	630p	630p	630p	1130p	86	0	5760	7076	—	Conn Jct 2 Lake (Lineup ahead)
	217	Hanes	Steed	730p	730p	730p	—	83	0	—	—	—	Lt 8/0
	9740			1145p			—					—	
	220	Chapman	Dewey	1015p			—	80	0				44 C Lake


STONY RIDGE
LUCKEY
PEMBERVILLE
WOODSIDE
WAYNE
HATTON
JACKSON
FOSTORIA
LOUDEN
LANDCRAF
BERWICK
P.M.
1
2
3
4
5
6
7
84
233
45
9739
218
46
9741
23
47
151
236

dual control switch is being hand-operated. When operated by the switch machine, the signals tell the story.

Telephones for switching and work trains.

Telephones are not required in the regular dispatching of through movements of trains under this system except to announce to the dispatcher the approach of trains about to enter the territory and to enable the dispatcher to announce to other districts when trains will arrive from the controlled territory; they are also used for the handling of work trains, the switching of cars and for communication with train crews in cases of emergency. Telephones connecting directly with the dispatcher's office are available at : *a*) each passing siding switch, cross-over or controlled group of switches and signals, *b*) each switch (not located in a controlled group) where a train can clear the main track, *c*) each intermediate pair of signals, *d*) each way station and *e*) the general yardmaster's office at Stanley Yard.

If it should be necessary for a train to do work between certain points, its crew obtains the consent of the dispatcher who designates the working and time limits and protects with stop signals. If a train should have occasion to do switching at the end of a passing siding, permission is obtained from the dispatcher. He gives over, as it were, for a specified time, the portion of the line required for the work and protects with stop signals. If a train should go into the clear at an outlying switch not controlled by the dispatcher, it does so with his knowledge and consent and must not come out without his consent. Trains cannot enter the controlled territory without the dispatcher's consent. If they enter on the main track or other signaled track such consent is manifested by signal indication.

The new system was placed in service in *one minute*, at which time all trains in the district stopped, and then immediately proceeded in accordance with a signal indication. It so happened that two trains were stopped. Within 10 minutes the reports of all field men had been received by telephone, indicating that all apparatus was in service as intended.

[656 .222.6 (.73)]

The importance of accelerating freight train movement, (1

By B. H. MANN,
CONSULTING SIGNAL ENGINEER, MISSOURI PACIFIC RAILROAD.

Figs. 1 to 5, pp. 1106 to 1109.

(*Railway Age.*)

The purpose of this paper is to use the studies made of the operations of various railroads to show that, on the one hand, where a management contemplates an increase in the size of the power or other means to produce more gross ton-miles per train hour through an increase in train load, it is also desirable to accompany such a plan by roadway improvements based on a scientific study of acceleration of the train. If this is not done, the increase in gross ton-miles per train hour which should result from the increased train load may be, in part, nullified by a decrease wich is brought about by a slowing down in the train movement. On the other hand, even though an increase in draw bar pull is not contemplated, a material increase in gross ton-miles per train hour may come both from acceleration and through a greater train load by a scientific plan of improvement of the single track.

Freight train economies through acceleration of trains are a matter of factory production by the superintendent. The superintendent manufactures gross ton-miles and sells revenue ton-miles.

An increase in gross ton-miles per train hour is produced in two ways: 1. by greater train load and 2. by acceleration of movement of the train. The appended freight train performance diagrams show that as far as the increase in the train load is concerned, the progress is good, but where acceleration of freight train speeds is concerned, there are great differences in the performances of the railroads. The diagrams show that whereas some railroads are increasing their factory output by raising the train loads and by accelerating the speed of trains, other roads, although increasing train loads satisfactorily, have not kept pace with their acceleration.

The diagrams show also that there is a limit, a critical point, on a freight train subdivision, both for train load and number of trains, at which limit the average gross ton-miles per train hour seem to be relatively fixed. Further increase in train load does not result in any increase in the gross ton-miles per train hour. The diagrams also indicate that on a single track freight train subdivision, when the movement exceeds a certain number of trains, the curve showing the output flattens out so that, unlike other lines of business, in railroading more production does not always mean more profits per unit or train.

(1) From an address delivered before the American Association of Railroad Superintendents, San Francisco, Cal., 21-24 June 1927.

Fig. 1. — Two Missouri Pacific trains meeting on a lap siding without stopping.

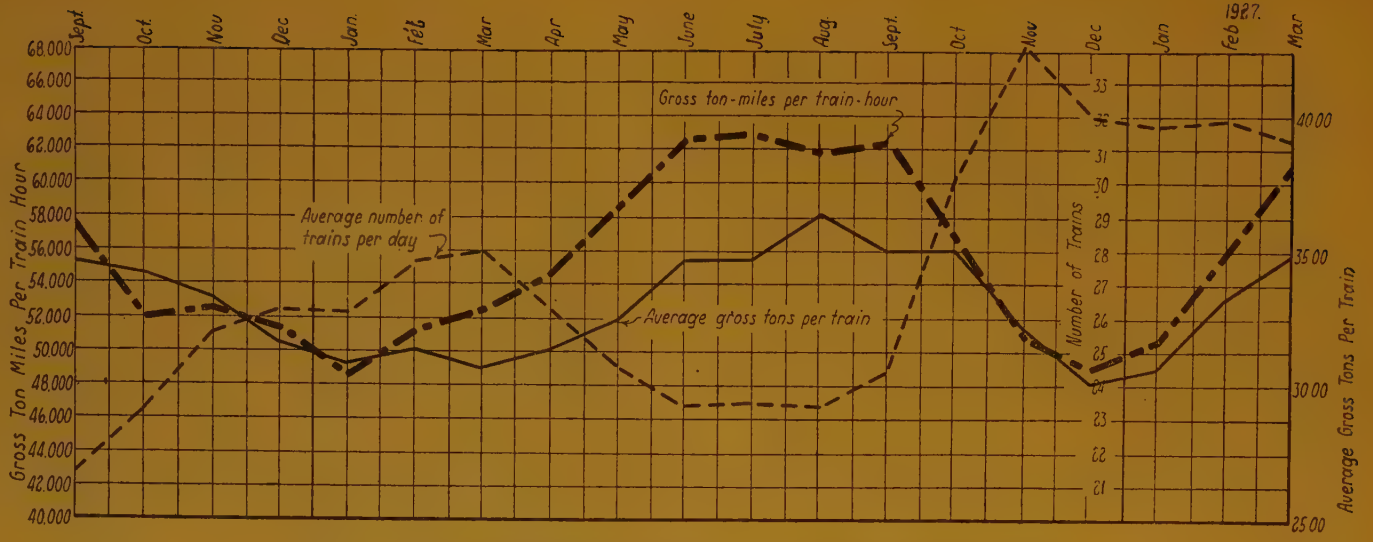


Fig. 2. — Diagram showing the influence of the number of trains on output.

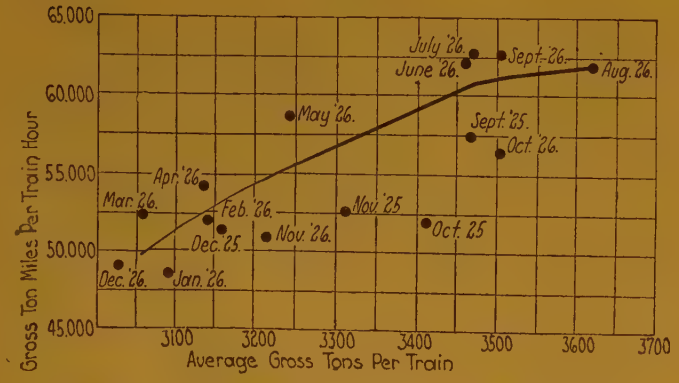


Fig. 3. — The influence of train load on gross ton-miles per train hour.

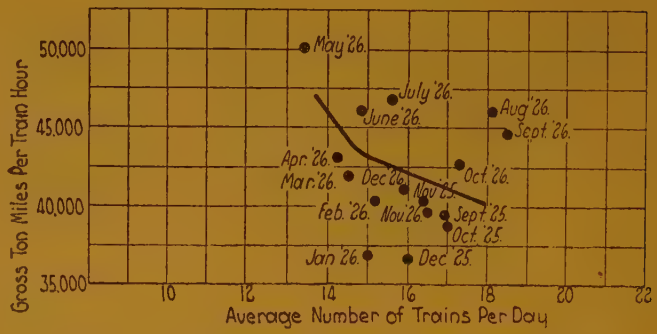
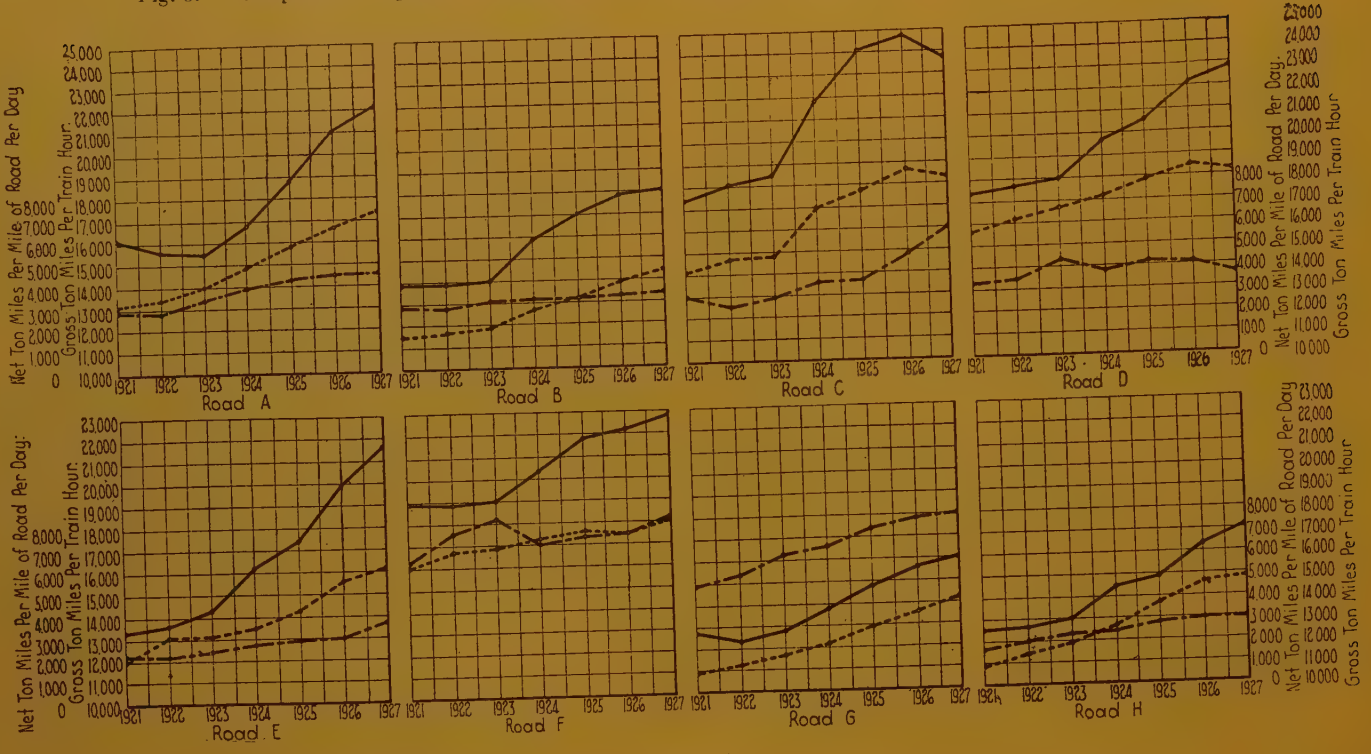
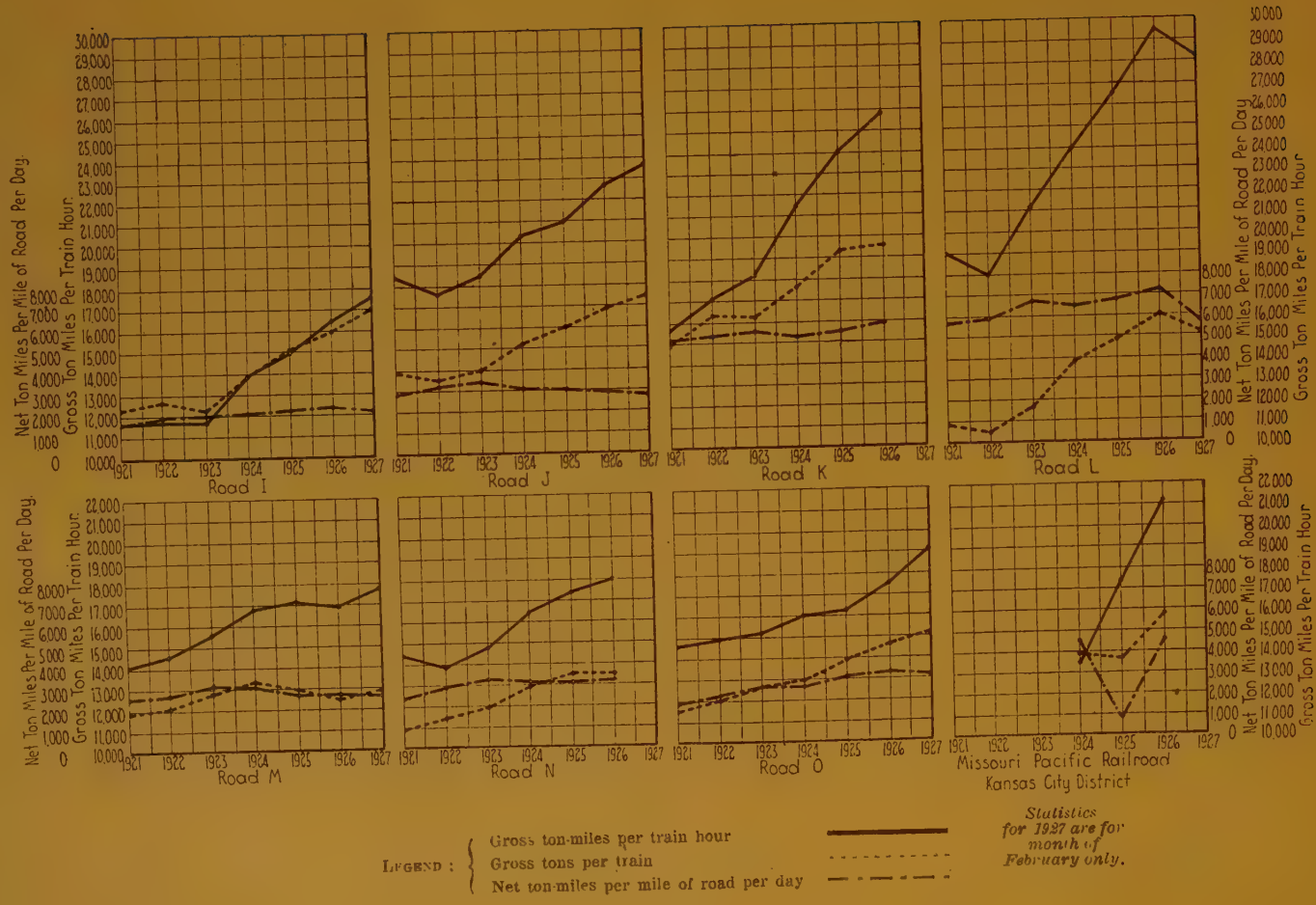


Fig. 4. — The influence of the average number of trains on gross ton-miles per train hour.

Fig. 5. — Comparison of operating results on 16 railroads having varying operating equipment and conditions.




Net Ton Miles Per Mile of Road Per Day
Gross Ton Miles Per Train Hour
Road I
Road J
Road K
Road L
Road M
Road N
Road O
Missouri Pacific Railroad
Kansas City District
1921
1922
1923
1924
1925
1926
1927
LEGEND :
Gross ton-miles per train hour
Gross tons per train
Net ton-miles per mile of road per day
Statistics for 1927 are for month of February only.

An efficient subdivision

The 56-mile single track subdivision of the Missouri Pacific between Kansas City, Mo., and Osawatomie, Kan., with a rolling gradient, the maximum being 1.2 %, supplies an excellent illustration. A 22.6 % increase in the average speed of freight trains, a 20 % increase in ton-miles per train hour and a reduction of over 850 tons in coal consumption per month were accomplished on this subdivision during 1926. The average speed over the 112 miles, including stops, has been increased from 9.81 miles an hour to 12.03 miles an hour. This includes 3 hours 30 minutes average detention for the turn-around at Kansas City. These results have been accomplished by relocating passing tracks and adding lap sidings at other points in addition to the installation of a controlled manual block signal system by which trains are operated by signal indication without written train orders. In compliance with the orders of the Interstate Commerce Commission and to serve as an additional safety factor, train control of the intermittent inductive type of the National Safety Appliance Company was also installed. These changes were carried out in accordance with a plan developed in an extensive study of traffic. A full description of the methods used in bringing this stretch of track to its present efficient operation will be found in the *Railway Age* of 19 December 1925.

In 1924, the gross ton-miles per train hour for this subdivision averaged 18 500. The output in the peak load month in 1925 represented an increase of 20.9 % over the output under the ordinary train order system as operated in 1924 and was brought about through the installation of single track improvements outlined above.

An increase by the same amount from 1925 to 1926, due solely to the co-operation and loyalty of the men, raised the total increase over the 1924 output to 42 %. Thus, it will be seen that the percentage of increase due to the handling of the facilities by the men was approximately as great as that brought about by putting in the facilities themselves.

Figure 2 shows the value of the influence of the number of trains on the output. This diagram represents one freight train sub-division's performance for a number of months. The peak load months for gross ton-miles per train hour are May, July and August. In the months of October, November and December the train load was reduced, due to the increase in the number of trains necessary to handle the business. The chart shows also that notwithstanding the variation in train loads, the gross ton-miles per train hour may be practically the same; therefore, increasing the train load does not always increase the factory output. On this particular subdivision, when the average gross tons per train pass 3 500, the limit is reached. This shows that the subdivision is in need of facilities to accelerate its trains and that also through this, the train load may be increased and the output increased in both ways.

The curve in figure 3 represents on the horizontal co-ordinate, the train load, and on the vertical co-ordinate, the gross ton-miles per train-hour. This curve shows that with a train load ranging from 3 050 tons to nearly 3 200 tons the rate of increase in the gross ton-miles per train hour is about the same. For train loads in excess of 3 200 tons the rate of increase is less and decreases still further for train loads of over 3 500 tons. Due to the fact that the train load and the number of trains depend upon each other and one influences the other through acceleration, the rate of increase changes. For train loads above 3 500 tons the curve of gross ton-miles per train hour flattens out so that in the peak load period it made very little difference on this particular subdivision what increase in train load the superintendent

effected, the gross ton-miles per train hour remained the same.

Figure 4, depicting the operation of another sub-division, similarly represents the influences of the number of trains. There is a critical point, on a single-track subdivision operating a certain number of trains, represented here by approximately 14.5, where a reduction in the number of trains increases the gross ton-miles per train hour much more rapidly. Where this condition exists, it shows that there is necessity for some improvement of that single track subdivision to permit the superintendent to keep up the normal rate of increase of gross ton-miles per train hour, even though his number of trains per day amounts to as many or more than 15.

Performance on various railroads.

As an indication of the relative increases that have occurred in train load and train acceleration, charts have been made covering the performance of 15 railroads in various parts of the country, showing the relative curves of gross ton-miles per train hour, gross tons per train and net ton-miles per mile of road per day. A resume of these diagrams, as shown in figure 5, is interesting and informative.

Percentage figures of increase of 1926 over 1921 are not shown for comparative purposes between these different railroads or between these roads and the Kansas City district of the Missouri Pacific as such comparisons under the varying circumstances that existed during these years would be of relatively little value. However, the very satisfactory improvement in the gross ton-miles per train hour on the Kansas City district can be noted from the extreme steepness of the curve on its chart. The acceleration of trains on this district made possible an increase in the train load so that both factors making up the gross ton-miles per train hour were benefited.

The good results in volume production of gross ton-miles per train hour by a scientific improvement of the Kansas City district have been confirmed by operations on a second freight train subdivision where certain territories were improved by continuous double track, certain other stretches by a scientific rearrangement of the single track and certain other sections were given no additions to increase the capacity. The percentage improvement in operations based on the investment was relatively quite favorable in the stretches on which the scientific improvement of single track had been made.

The actual practical value of a scientific study of any one main track to accelerate train movements where an increase in capacity is contemplated has now been demonstrated by an experience of two years' development on at least two independent single track freight subdivisions and this question, therefore, no longer is an unproved theory.

MISCELLANEOUS INFORMATION

[656 .254 (.73)]

1. — Improved train indicators on Brooklyn subways.

Figs. 1 and 2, pp. 1112 and 1113.

(*Railway Age.*)

The illuminated track model (familiar to all who have visited any of the large terminal signal cabins where this facility is in use) which keeps the towerman constantly informed, as to each track circuit in his territory, whether that section of track is or is not occupied by a train (or car), has been elaborated, in the chief dispatcher's office at Brooklyn, N. Y., of the Brooklyn-Manhattan Transit Company, so that the indicating lamp not only shows the presence (or absence) of the train, but also its location, whether at one or the other end of the track circuit and whether in motion or at a standstill; and the dispatcher, by following the changes in the intensity of the light from the lamp can tell in which direction the train

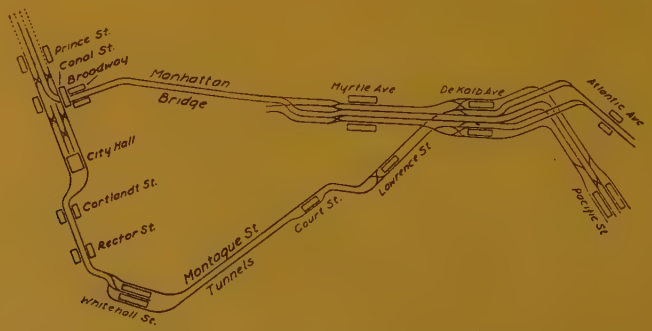


Fig. 1. — Brooklyn-Manhattan Transit Subways, New York.

Lines of the Brooklyn-Manhattan Transit Company (subway and elevated) between Pacific Street, Brooklyn, and Prince Street, Manhattan.

is moving. With experience an observer can estimate its speed. The Brooklyn dispatcher has at hand, at any instant, a record of the movement of every train in his territory, some of which is several miles distant.

The arrangement of the indicating lights, and their connections to the track circuits, have been devised and developed by G. C. Whitney, formerly with the Brooklyn-Manhattan Transit Company, but now chief of the division of signal engineering for the New York State Transit Commission (New York City). Important features of the arrangement have been patented and patents on others are pending. The lamps are « inductively coupled » to the track circuit between the source of power and the rail, and are energized continually. The current coming to them is, however, variable in accordance with whether the track is or is not occupied and whether the train is at the near

or the far end of the section. When the track is wholly unoccupied, the lamps receive so little energy that they are dark. By the entrance of a train into the section, the car-wheel shunt increases the flow and this is reflected in the indicator lamp, the filament glowing dimly. As the train proceeds through the track section, the lamp grows brighter. With a train moving in the opposite direction, the lamp would show full brilliancy at first, but would be fainter as the train proceeded. The arrangement requires so little power that the mileage of track possible to indicate in a single tower is practically unlimited.

Fig. 2. — Section of train indicator.

On an electrified road (as in the case of the Brooklyn lines) the propulsion current, by affecting the indicating current, informs the dispatcher whether or not the train is using power.

The board containing this track model is about 6 feet wide by 4 feet high and is mounted vertically on the wall of the office. The general shape of the lines on the model is as shown in figure 1. Prince Street, on Broadway, Manhattan, is about two miles, in an air line, from the Brooklyn headquarters. The length of road now covered is 7 1/2 miles including 19 miles of track. The average length of track circuit per indicating lamp is 475 feet. Provision is made for future additions to the board to include the portion of the system known as Center Street Loop between Chambers Street, Manhattan and Williamsburg Bridge. This will add 1 1/2 miles of road, 10 miles of track and 141 indicating lamps to the portion at present in service.

A small section of the board, including the junction at De Kalb Avenue, is shown in figure 2. Some of the lights are colored to facilitate distinction between the indications of different tracks. The number of lamps now in service is 215.

[621 .335 (.44)]

2. — Test of Oerlikon electric locomotives, Paris-Orleans Railway.

(*The Railway Gazette.*)

Some tests were recently carried out with the new Oerlikon electric locomotives of the Paris-Orleans Railway. These locomotives, which are equipped with four motors having a one-hour rating of 1 800 H. P. and a continuous rating of 1 500 H. P. at 1 350 volts, have to deal with most varied duties, as they are not only used for hauling goods and perishable traffic trains and ordinary passenger trains, but are also utilised to a considerable extent for express service. The average trailing loads and nominal speeds for these different classes of traffic are as follow :

Freight trains	800 to 1 200 tons and 18.5 to 25 miles per hour.
Produce trains	350 to 500 tons and 40.5 miles per hour.
Ordinary passenger trains	250 to 350 tons and 40.5 miles per hour.
Express trains	300 to 500 tons and 46.5 miles per hour.

The maximum speed is 28 to 31 miles per hour for freight trains and 56 miles per hour in the other cases.

The trials were carried out with a train consisting of 58 empty goods wagons, representing a weight of 578 tons, excluding the locomotive. The current of motors was kept at about 250 amperes, the average pressure being 1 230 to 1 250 volts. The variation in current between notches was measured by means of a recording ammeter. As was to be expected, the greatest variation took place for parallel grouping with 100 % field where it amounted, on an average, to 22 amperes per motor, corresponding to a variation in tractive effort of 2 090 lb. The maximum variation in tractive effort recorded was 3 300 lb., corresponding to 35 amperes per motor. The starting time required to reach a speed of 26 miles per hour on a gradient of 1 in 125, for instance, was 4 min. 20 sec., and to attain a speed of 23.3 miles per hour on a gradient of 1 in 143, 3 minutes.

In order to determine the acceleration obtainable with the locomotives when used for ordinary passenger service or express service, tests were carried out with a train of 290 tons. The values obtained for acceleration were as follow :

0.448 mile per hour per second on gradients of 1 in 834, with an average starting current of 250 amperes per motor.

0.851 mile per hour per second on the level with an average starting current of 350 amperes.

The average power consumption, after deduction of power consumed by auxiliaries, was only 19.3 watt-hours per ton-mile for series parallel operation of motors (normal service) with a trailing load of 578 tons, a maximum speed of about 27.9 miles per hour, and an average pressure of 1 400 volts.

[625 .245 (.42)]

3. — Standard type vehicles for heavy merchandise, London Midland & Scottish Railway.

Figs. 3 to 9, pp. 1116 and 1117.

(From *The Railway Engineer*.

Since amalgamation, the London Midland & Scottish Railway has endeavoured, so far as possible, to concentrate on a number of standard types of goods vehicles for the conveyance of heavy and bulky merchandise. The systematic standardisation of various types of railway rolling-stock has undoubted economic advantages, both from the point of view of construction and of maintenance, and these are of particular importance to a company as large as the London Midland & Scottish Railway. The vehicles described in this article, and illustrated in figures 3 to 9, represent the types selected for future service on the London Midland & Scottish Railway. By close attention to design and the distribution of weight, it has been possible to considerably reduce the tare in the new vehicles, and it will be appreciated that for the special loads in question this is a matter of primary importance, since it is the combined weight of the load and the carrying vehicle which has to be considered in connection with older bridges on certain sections of the railways. There is a tendency for special loads, such as portions of heavy electrical machinery, turbines, ship forgings, etc., to increase both in size and weight, so that the latest vehicles are designed to give as much latitude as possible. As far as has been found practicable, the principal material used throughout in their construction is steel, the only wood used being for floors, baulks, etc. Wherever possible, the compound lever brake is fitted in preference to the more slowly-acting screw brake used on the older types of wagons. In some cases where the design does not allow of the former being applied, independent double brakes are fitted.

There is a considerable number of special vehicles formerly in the ownership of the constituent companies of the group, such, for instance, as gun trucks, armour plate trucks, trucks for the conveyance of agricultural implements, large wheel or pulley trucks, etc.

The new type 20-ton implement truck illustrated is constructed of steel, with a wooden floor for carrying chemical pans, traction engines, and similar bulky loads. To allow of loads being lowered in order to clear structures, a well is arranged in the centre.

In order that ships' stern posts and other loads of awkward shape may be carried readily, an 8-ton deep case truck design has been adopted. This is a steel skeleton type, and is without floor.

For the conveyance of glass, a 12-ton steel truck fitted with screw adjustments, which may be raised or lowered, has been designed. It is provided with a deep well, so that practically any size or shape of load may be carried with safety.

A number of 25-ton four-wheeled trolleys are included in the standardised types. A certain number of these are fitted with baulks of a special type, having suitable adjustment for the conveyance of ships' propellers of varying sizes. The remainder are equipped with ordinary baulks for the support of loads which can be put through the well openings within a short distance of rail level. This method of low loading is of considerable advantage.

The 40-ton bogie trolleys, used generally for heavy loads, such as ships' sterns, electric

Figs. 3 to 9. — Latest types of standard special heavy merchandise vehicles for service on the London Midland & Scottish Railway.

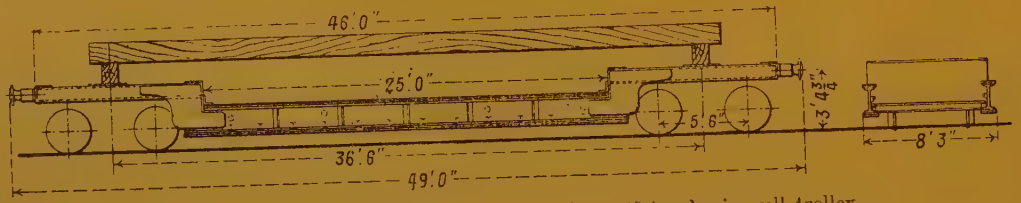


Fig. 3. — London Midland & Scottish Railway 40-ton bogie well trolley.

Tare, with baulks : 21 tons 17 cwt.; without : 20 tons 0 cwt. — 1-chain curve.

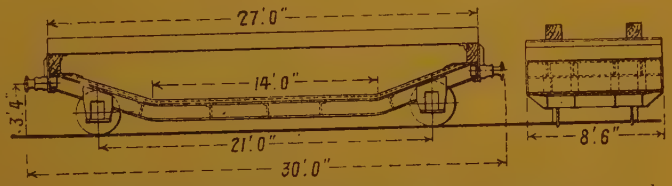


Fig. 4. — London Midland & Scottish Railway 20-ton implement truck.

Tare, with baulks : 10 tons 17 cwt.; without : 8 tons 17 cwt.
1 ½-chain curve.

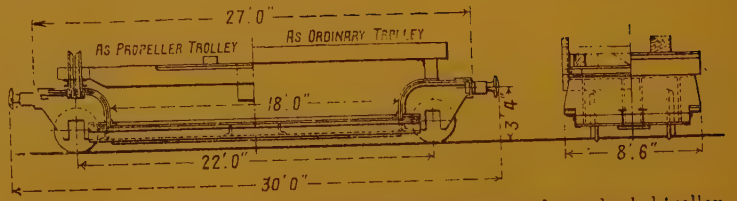


Fig. 5. — London Midland & Scottish Railway 25-ton four wheeled trolley.

Tare, with baulks : 11 tons 12 cwt.; without : 10 tons (propeller).
Tare, with baulks : 10 tons 16 cwt.; without : 9 tons 12 cwt. (ordinary). — 1 ¾-chain curve.

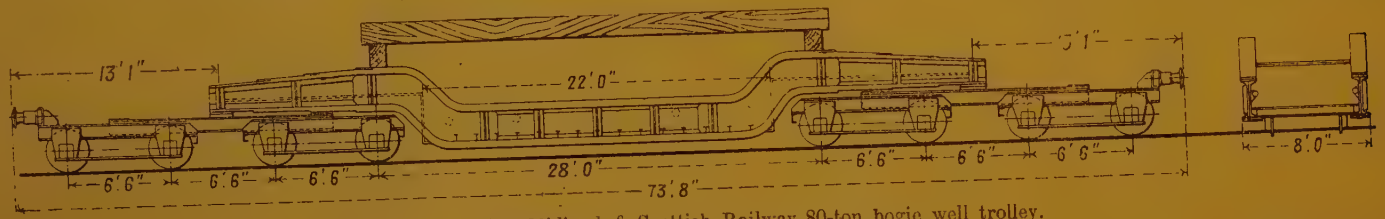


Fig. 6. — London Midland & Scottish Railway 80-ton bogie well trolley.

Tare, with baulks : 47 tons 13 cwt.; without : 45 tons 10 cwt. — 1-chain curve

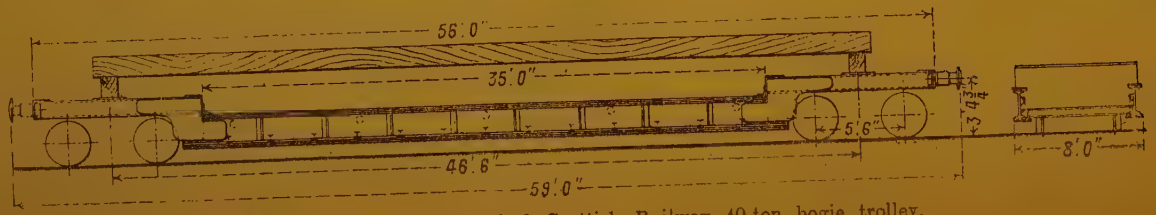


Fig. 7. — London Midland & Scottish Railway 40-ton bogie trolley.

Tare, with baulks : 24 tons 19 cwt.; without : 22 tons 0 cwt. — 1 ½-chain curve.

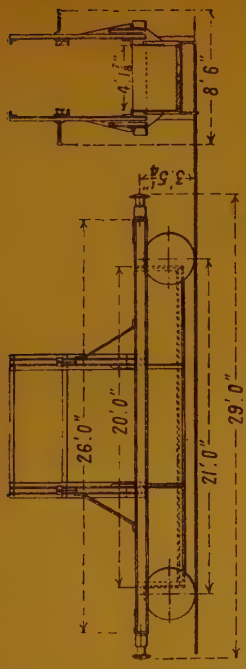


Fig. 9. — London Midland & Scottish Railway 12-ton glass truck.

Tare : 8 tons 3 cwt. — 1½-chain curve

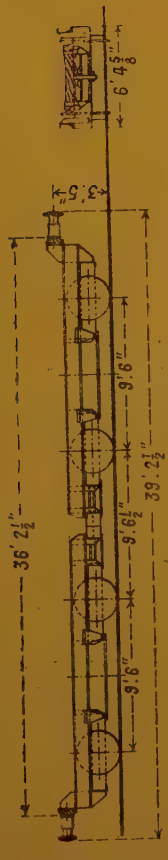


Fig. 8. — London Midland & Scottish Railway 50-ton twin girder truck.

Tare : 12 tons 6 cwt. (per pair). — 1-chain curve.

stators, cylinders, etc., have special low wells with adjustable and removable crossbars, which allow the loads to come within 7 inches of rail level. When supported on the crossbars, the load is only 1 ft. 3½ in. above the level of the rail. There are two types of trolley conforming generally to this standard, the principal difference between them being in the length and width of the wells.

For the conveyance of special loads, such as transformers, anvil blocks, condensers, reaction chambers, etc., the 80-ton bogie well trolley is provided. The well is low and the crossbars are adjustable and removable, allowing the load to come within 7 inches of the rail level. The load when supported on the cross bars is 1 ft. 5½ inches above the level of the rail.

Twin girder trucks of 50 tons capacity are included in the standardised designs. These have bolsters so arranged that long and deep girders, boilers, cylinders and similar heavy and bulky loads are readily and safely carried. A feature of these sets is that when the load is secured to them it becomes the coupler to the pair. The advantage of this arrangement will be obvious when it is mentioned that many of these loads are as much as 100 feet long or of such length as to render the use of a coupling to the trucks themselves an impossibility. In conclusion, we have to express our indebtedness to Mr. Lemon, Carriage and Wagon Superintendent, for his kindness in supplying much of the information upon which this article is based, and to the London Midland & Scottish Railway Company for permission to reproduce this and the accompanying line drawings. The drawings, in addition to giving the leading dimensions, also show the tare of the vehicle, and the smallest radius curve round which they may be worked safely.

NEW BOOKS AND PUBLICATIONS

[313 .385. (02]

KIRKUS (A. E.), O. B. E., M. Inst. T., Director of Statistics, Ministry of Transport. — **Railway statistics; their compilation and use.** — One volume in 8vo (8 1/2 × 5 1/2 inches) of 134 pages. — 1927. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London W. C. 2. — Bath, Melbourne, Toronto & New York. — Price : 5 sh. net.

Railway statistics are unfortunately regarded by many as being of interest rather to the theorist than to the practical man, but Mr. Kirkus in his excellent book recently published shews us that statistics are really a simplified means of keeping a check on the efficiency of railway operations which are of ever increasing complexity and magnitude. Statistics are a necessity to all concerned in the control of railway operations, whilst they are being increasingly utilised by traders since the passing of the Railways Act. It is particularly fortunate therefore that at this time Mr. Kirkus should have presented a book that shews clearly and completely the connection between a page of figures and the practical operations of train working, shunting, warehouse working, etc. One need have no mathematical qualifications to be able to acquire from a perusal of this work the ability to obtain by glancing over suitable returns a guide to the efficiency with which various classes of work are being performed.

Particular attention may be directed to the chapter on derivative statistics which have been devised from time to time as suitable tests to apply to various phases of railway operation.

A description is given of the figures which are in common use shewing how they are calculated and the nature of the conclusions that may safely be drawn from them. The most satisfactory methods of using these statistics are indicated together with notes on the disturbing factors that it may be necessary to take into consideration. This part of the subject has perhaps the greatest scope for development and a careful study of the derivative statistics already in use will prove a useful preliminary to attempts to devise new statistical methods of testing the efficiency of various operations.

Those who have made use from time to time of the monthly and annual publications of the Ministry of Transport and who have perhaps rather taken for granted the clearness with which the figures are presented and the ease with which they can be consulted, will be particularly interested in the chapter on the presentation and application of statistics. A description is given of the means adopted for the construction of tables which shall give the maximum of information with the minimum of effort to the readers. The few notes on diagrammatic representation of statistics are sufficient to make one wish that space could be found for a few examples in the Ministry's publications.

Although the book is concerned almost entirely with British statistics, it concludes with a valuable comparison between the figures compiled in Great

Britain and in other countries. Those who are always ready to disparage the results obtained in their own country would do well to study the differences which at present exist and render satisfactory comparisons extremely difficult.

Mr. Kirkus has succeeded in compiling a book which should be read by all who are interested in railways. Whilst on the one hand, it can be recommended to those who have previously regarded statistics as having no practical value, eminent statisticians will find that Mr. Kirkus sets them a problem in costing which will probably occupy their attention for many years to come.

X.

MONTHLY BIBLIOGRAPHY OF RAILWAYS [1]

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General secretary of the Permanent Commission of the International Railway Congress Association.

[016 .385 (02]

I. — BOOKS.

In French.

1926 624 .9 (02 & 695. (02

ALDEBERT (E.) & AUCAMUS (E.).

Charpente et couverture. Deuxième édition, par E. Aucamus, ingénieur honoraire du Chemin de fer du Nord, et A. Lemaire, ingénieur des Arts et Métiers.

Paris, (6e), Librairie Dunod, 92, rue Bonaparte. (120×180), de VIII-472 pages, avec 488 fig. (Prix : 42 francs.)

1926 531. (02

ALGRIN (M.), ingénieur des Arts et Métiers.

Eléments de mécanique générale et de mécanique appliquée.

Vannes, impr. Lafolye frères et Cie; Paris, Ecole spéciale des travaux publics, rue du Sommerard, rue Thenard et boulevard Saint-Germain. In-8°, 397 pages et fig.

1926 385. (09.1 (.44)

MINISTÈRE DES TRAVAUX PUBLICS DE FRANCE.

Carte des chemins de fer français. (1er novembre 1926), à l'échelle du 1/1.000.000e en 8 couleurs.

Paris (5e), Librairie Delagrave, 15, rue Soufflot. (108×122 cm.), contenant le plan des 11 principales villes. (Prix : en feuilles 25 francs; montée sur toile et baguettes, 70 francs.)

1926 621 .3 (02

DACREMONT (Edouard).

Electricité. Deuxième partie : Applications industrielles. Tome I. Canalisation et distribution. Eclairage électrique. Stations centrales. Transport électrique de l'énergie. Traction électrique. Tome II. Electro-chimie. Télégraphie. Téléphonie. Contrôle et tarification de l'énergie électrique. Applications industrielles du moteur électrique.

Tours, impr. R. et P. Deslis; Paris (6e), Dunod, éditeur, 92, rue Bonaparte. 2 vol. in-8° avec fig. Tome I: XI-632-10a pages; tome II : 633 à 1 212 pages.

1926 669 .1 (02

FABART (A.-E.).

Manuel du fondeur.

Paris, J.-B. Baillière & fils. (115×160), de 416 pages avec 124 fig.

1926 621 .3 (02

FISCHER-HINNEN (J.), professeur à l'Ecole technique de Winterthur (Suisse).

L'électrotechnique des praticiens, avec nombreux exemples de calculs et d'essais de machines et transformateurs.

Saint-Amand (Cher), impr. R. Bussière, Paris (6e), Dunod, 92, rue Bonaparte. In-8°, XVIII-623 pages avec fig.

1926 62. (01

FONTVIOLANT (Bertrand de), professeur à l'Ecole centrale des Arts et Manufactures.

Résistance des matériaux. Tome II : Système en treillis. Arcs isostatiques et hyperstatiques. Portiques à une travée et portiques continus.

Paris (6e), J.-B. Baillière et fils, éditeurs, 19, rue Hautefeuille. (160×235), de 700 pages avec 200 fig. (Prix : 90 francs.)

1926 62. (01 & 721. (02

GUILLOT (L.), professeur de mécanique à l'Ecole des Arts et Métiers d'Angers.

Cours de mécanique. Rédigé conformément aux nouveaux programmes des Ecoles nationales d'Arts et Métiers. Complément : Notions sur la résistance du béton armé. Résistance des poutres droites.

Paris (6e), 15, rue des Saints Pères; Liége, 8, rue des Dominicains. Librairie polytechnique Ch. Béranger. (160 × 220), de 154 pages avec 94 fig. (Prix : 17 francs.)

1926 621 .116. (02

HOEHN (E.), ingénieur en chef.

Rivure et soudure des chaudières à vapeur.

Paris (6e), 15, rue des Saints-Pères; Liége, 8, rue des Dominicains. Librairie polytechnique Ch. Béranger. (150×220), de 155 pages avec 154 fig. (Prix : 20 francs.)

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[1] The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International of Brussels. (See « Bibliographical Decimal Classification as applied to Railway Science », by L. WEISSENBRUCH in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1926 621 .3 (02

JANET (Paul), membre de l'Institut, professeur à la Faculté des Sciences.

Leçons d'électrotechnique générale, professée à l'Ecole supérieure d'électricité. Tome I[er] : Généralités, courants continus. Sixième édition. — Tome II : Courants alternatifs sinusoïdaux; alternateurs; transformateurs. Sixième édition. — Tome III : Moteurs à courants alternatifs; couplage et compoundage des alternateurs; transformateurs polymorphiques. Cinquième édition.

Paris, Gauthier-Villars et C[ie], éditeurs. — Tome I[er] : un vol. in-8°, de 418 pages, avec 181 fig. (Prix : 84 francs.) — Tome II : un vol. in-8°, de 464 pages avec 202 fig. (Prix : 84 francs.) — Tome III : un vol. in-8° de 414 pages, avec 134 fig. (Prix : 60 francs.)

1926 624 .2 (02

KLUZ (Thomas), ingénieur des ponts et chaussées.

Calcul graphique des poutres continues à section constante.

Paris, éditeur : Le constructeur de ciment armé, 148, boulevard Magenta. (160×240), de 53 pages, 26 fig. & 3 tableaux. (Prix : 10 francs.)

1926 62. (02

LAHARPE (de).

Notes et formules de l'ingénieur.

Paris, Albin Michel, éditeur, 22, rue Huyghens. 22[e] édition. 3 volumes, formant ensemble 4 500 pages et 3 500 fig. (Prix : 290 francs.)

1926 669. (02

LE BOUTEILLER (Marcel), ingénieur A. M.

Modelage mécanique. Fonderie et étude de la pièce moulée.

La Chapelle-Montligeon (Orne), impr. de Montligeon, Paris, 15, rue des Saints-Pères; Liége, 8, rue des Dominicains, Librairie polytechnique Ch. Béranger. In-8°, 120 pages avec 209 fig.

1925 691. (02

LEDUC (E.), chef honoraire de la section des matériaux de construction au Conservatoire National des Arts et Métiers.

Chaux et ciments. Historique. Théories anciennes et modernes. Développement économique.

Paris, impr. Jouve & C[ie], 15, rue Racine; lib. J.-B. Baillière et fils, 19, rue Hautefeuille. 3[e] édition. In-18, 464 pages, 91 fig. et 82 tableaux.

1926 621 .3 (02

MAUDUIT (A.), ancien élève de l'Ecole polytechnique, professeur à la Faculté des Sciences de Nancy.

Installations électriques à haute et basse tension. Production, transport, distribution et utilisation de l'énergie électrique.

Paris (6[e]), Dunod, éditeur, 92, rue Bonaparte. 2 vol. (160×250), de xxvi-730 et 636 pages, avec 578 fig. (Prix : 150 francs.)

1926 313 .385 (.493) & 385. (08 (.493)

MINISTÈRE DES CHEMINS DE FER, MARINE, POSTES, TÉLÉGRAPHES, TELÉPHONES ET AÉRONAUTIQUE. Chemins de fer et Service de l'électricité. Marine, postes, télégraphes et téléphones.

Compte rendu des opérations pendant l'année 1924. Rapports présentés aux Chambres législatives par M. le Ministre des chemins de fer, marine, postes, télégraphes, téléphones et aéronautique.

Liége, Imprimeries nationales des militaires mutilés et des invalides de la guerre, fournisseurs du Roi, rue Paradis, 130. In-4°, 67-9-25-14-24 pages et tableaux.

1926 341 .324. (02

PESCHAUD (Marcel), Secrétaire général du Comité de Direction des Grands Réseaux de chemins de fer français.

Politique et fonctionnement des transports par chemins de fer pendant la guerre.

Paris (5[e]), Les Presses universitaires de France, 49, boulevard Saint-Michel. Un volume in 8°, de XII-308 pages. (Prix : 35 francs.)

1926 537. (02 & 621 .3 (02

RZIHA (E.-L.) & SEIDENER (J.).

Manuel de l'ingénieur électricien. Traduit sur la sixième édition allemande par **Roger Weiller.**

Paris (6[e]), 15, rue des Saints-Pères; Liége, 8, rue des Dominicains. Librairie polytechnique Ch. Béranger. 2 vol. in-8° (120×190), d'environ 1 000 pages chacun, avec 1 794 fig. (Prix d'ensemble des deux volumes : 150 francs.)

1926 621 .33 (02

SEEFEHLNER (E.-E.), Dr. Ing.

Traction électrique. Manuel sur la théorie et l'application de la traction électrique aux chemins de fer.

Paris (6[e]), 15, rue des Saints-Pères; Liége, 8, rue des Dominicains. Librairie polytechnique Ch. Béranger. (200×280), de 694 pages avec 751 fig. et 1 planche. (Prix : 130 francs.)

1926 62. (01

TENOT (André), ingénieur des Arts et Métiers et de l'Institut électrotechnique de Grenoble.

Cours de résistance des matériaux à l'usage des élèves des établissements d'enseignement technique et des ingénieurs. Calcul des éléments de construction. Méthodes générales pour la recherche des caractéristiques mécaniques des matériaux.

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1926 625 .3 (02

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Les rampes de chemins de fer et les lignes de montagne.

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ANDREAE (C.), Professor am Polytechnikum in Zürich.

Der Bau langer tiefliegender Gebirgstunnel.

Berlin W. 9, Verlag von Julius Springer, 1. Band, 150 Seiten mit 83 Abb. (Preis : 13.2 Rm.)

1926 621 .116. (02

BRAND (J.).

Technische Untersuchungsmethoden zur Betriebsüberwachung, insbes. zur Ueberwachung des Dampfbetriebes.

Leipzig, Verlag von Johann Ambrosius Barth. 8°. x-430 Seiten mit 334 Abb. (Preis : 29.40 Rm.)

1926 656 .254. (02

FINK (K.), Geheimer Baurat.

Das elektrische Fernmeldewesen bei den Eisenbahnen.

Berlin u. Leipzig, Walter de Gruyter & Co. Zweite verbesserte Auflage. Mit 54 Abb. Sammlung Göschen, Band 707. (Preis geb. : 1.50 Rm)

1926 691. (01

GRAF (M. O.).

Deutscher Ausschuss für Eisenbeton.

Berlin, Verlag von Wilhelm Ernst u. Sohn. 32 Seiten mit 36 Abb. (Preis brosch. : 6.90 Rm.)

1926 625 .253. (01

Internationale Versuche mit der Westinghouse Bremse an einem Güterzug der von den Verwaltungen der Französischen Bahnen vorgestellt wird. Italien-Schweiz, März-April, 1926.

Paris (6e), G. Ficker, 6, rue de Savoie. 51 Seiten mit Abb. (Preis : 15 Frank.)

1926 621 .132.8 (02 & 621 .43 (02

JANKE (Werner), Ing. für Kraftfahrzeuge zu Chemnitz.

Der Eisenbahn-Öltriebwagen.

Leipzig, Oskar Leiner. (Preis : 3.50 Rm.)

1926 694. (02

KERSTEN (C.).

Freitragende Holzbauten.

Berlin W. 9, Linkstrasse, 23-24. Verlag von Julius Springer. 2. Auflage. (Preis : 36 Rm.)

1926 721 .9 (02

LINGESLEBEN (E.).

Carl Lingesleben, Unternehmung f. Hoch-, Tief-, Beton- u. Eisenbetonbau, Halle a. S., 1875-1925.

Leipzig, Verlag von Johann Ambrosius Barth. 4°. 132 Seiten mit Abb. (Preis : 6.50 Rm.)

1926 656 .1 (02 & 656 .2 (02

MERKERT (E.).

Der Lastkraftwagenverkehr seit dem Kriege, insbesondere sein Wettbewerb und seine Zusammenarbeit mit den Schienenbahnen.

Leipzig, Verlag von Johann Ambrosius Barth. 8°. VII-112 Seiten, mit 2 Textabb. (Preis : 6.60 Rm.)

1926 625 .251. (02

OPPERMANN (E. W.).

Berechnungsgrundlagen für die Bremswirkungen an Eisenbahnzügen.

Leipzig, Verlag von Johann Ambrosius Barth. 8°. 47 Seiten mit Abb. (Preis : 3.00 Rm.)

1926 721 .9 (02

PADLER (G.).

Grundlagen für den praktischen Eisenbetonbau. Unter Berücks. d. Bestimmungen d. Deutschen Ausschusses f. Eisenbeton vom September 1925.

Leipzig, Verlag von Johann Ambrosius Barth. 2., vermehrte Auflage. 8°. VII-299 Seiten mit Abb. (Preis : 9 Rm.).

1926 385 .5 (.43)

RICHARDT (Alexander), Dr. jur.

Die Änderung der Rechtsverhältnisse der deutschen Eisenbahnbeamten von 1920 bis 1924.

Berlin, Verlagsanstalt des Deutschen Beamtenbundes G. m. b. H. 129 Seiten.

1926 625 .13 (02

SCHAECHTERLE, Dr.-Ing.

Verstärkung, Umbau und Auswechselung von Eisenbahnbrücken.

Berlin N. W. 7, V. D. I. Verlag G. m. b. H. 160 Seiten mit 430 Abb. u. zahlreichen Tafeln. (Preis geb. : 20 Rm.).

1926 625 .13 (02

SCHMID (H.).

Statische Probleme des Tunnel und Druckstollenbaues.

Berlin W. 9, Verlag von Julius Springer. 148 Seiten mit 36 Abb. (Preis : 8.40 Rm.).

1925 621 .1 (02

VATER (Richard), Professor an der Technischen Hochschule Berlin.

Die Dampfmaschine, ihre Gestaltung und Verwendung. Neubearbeitet von Dr. Fritz SCHMIDT, Professor and der Technischen Hochschule Berlin.

Leipzig u. Berlin, Verlag B. G. Teubner. (Preis geb.: 2 Rm.).

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WEIRAUCH (W.), Dr. jur.

Die Eisenbahnverkehrsordnung vom 23. Dezember 1908 mit Allgemeinen Ausführungsbestimmungen sowie dem Internationalen Uebereinkommen über den Eisenbahnfrachtverkehr vom 30. Mai 1925 und dem Internationalen Uebereinkommen über den Eisenbahn-Personen- und -Gepäckverkehr vom 12 Mai 1925.

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1926 621 .338. (02

ZEULMANN (E.).

Elektrische Gleisfahrzeuge.

Leipzig, Verlag von Johann Ambrosius Barth. Gr. 8°. VIII-347 Seiten mit 253 Abb. im Text. (Preis : 14.00 Rm.).

In English.

1926 62. (02
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The engineering index, 1925.

New York, Published by the Society. 29 West 39th Street. (9 1/2 × 7 inches), 792 pages. (Price : $7.00.)

1926 656 .231. (02
BURTT (Philip), M. Inst. T.

Railway rates, principles and problems.

London W. C. 2, Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway. (5 1/2 × 8 1/2 inches), 167 pages. (Price : 6 s. net.)

1926 621. (02
COLVIN (Fred. H.) & STANLEY (Frank A.).

American machinists' handbook.

New York. McGraw Hill Book Co. Fourth edition (4 × 7 inches), 972 pages, illus., tables. (Price : $4.00.)

1926 621 .1 (02
EWING (Sir Alfred), LL. D., D. Sc., F. R. S.

The steam engine and other heat engines.

Cambridge, University Press. Fourth edition. (Price: 25 s. net.)

1926 313 .385 (.66) & 385. (08 (.66)
GOLD COAST RAILWAY.

Administration report for the year 1925-26.

Sekondi, Gold Coast. Railway Press. 4°, 63 pages, 12 tables & fig.

1926 62. (01
HATT (William Kendrick), C. E., & SCOFIELD (H. H.), M. E.

Laboratory manual of testing materials.

New York & London, McGraw-Hill Book Co., Inc. (5 × 7 inches), 182 pages, linecuts and tables. (Price : $2.00.)

1926 721 .9 (02
HOOL (George A.), S. B., consulting engineer, professor of structural engineering, University of Wisconsin & **WHITNEY (Charles S.),** M. C. E., consulting engineer, Milwaukee, Wis.

Concrete designers' manual : Tables and diagrams for the design of reinforced concrete structures.

New York & London, McGraw-Hill Book Company, Inc. 2d edition. Cloth (6 × 9 inches), 329 pages, tables, diagrams and charts. (Price: $4.00.)

1926 656. (01
JACKMAN (W. T.), Prof.

Economics of transportation.

Chicago, Ill., A. W. Shaw Co. 818 pages. (Price : $6.00.)

1926 385. 09.1 (.42)
Lord MONKSWELL.

The railways of Great Britain.

London, Geoffrey Bles, 22, Suffolk Street, Pall Mall. (8 3/4 × 6 × 1 1/2 inches), 254 pages. 27 illustrations and 4 gradient profiles. (Price : 12 s. 6 d. net.)

1926 313 .385 (.66) & 385. (08 (.66)
NIGERIAN RAILWAY AND UDI COAL MINES.

Administrative report for the year ending 31 March 1926.

Ebute Metta. Printed by the Superintendent of press. 79 pages, illust., with appendices and a map.

1926 025 .4
POLLARD (A. F. C.).

The decimal bibliographical classification of the Institut international de bibliographie.

London, S. W. 7. The Optical Society, Imperial College of Science and Technology, South Kensington.

1926 313 .385 (.942) & 385. (08 (.942)
SOUTH AUSTRALIAN RAILWAYS.

Annual report of the South Australian Railways Commissioner for the year 1925-26.

Adelaide, R. E. E. Rogers, Government printer, North Terrace. xxix-32 pages, 21 tables, fig. and a map.

1926 693. (02
SPALDING (Frederick P.).

Masonry structures.

New York, John Wiley & Sons. Second edition. (6 × 9 inches), 586 pages illust., diagrams & tables. (Price : $5.00.)

1926 721 .9 (02
SUTHERLAND (Hale), M. Am. Soc. C. E., associate professor of structural engineering, Massachusetts Institute of Technology, & **CLIFFORD (Walter W.),** M. Am. Soc. C. E., consulting engineer, Boston.

Introduction to reinforced concrete design.

New York, John Wiley & Sons, Inc.; London, Chapman & Hall, Ltd. Cloth (6 × 9 inches), 412 pages, 126 line cuts, tables, appendices with drawings. (Price : $4.00.)

1926 621 .13 (02
The locomotive in service.

London E. C. 4, The Locomotive Publishing Co., Ltd., 3, Amen Corner. (8 3/4 × 5 × 1/2 inches), 187 pages. (Price : 5 s.)

1926 721 .9 (02
URQUHART (Leonard Church), C. E., professor in charge of structural engineering, Cornell University, & **O'ROURKE (Charles Edward),** C. E., assistant professor of structural engineering, Cornell University.

Design of concrete structures.

New York & London; McGraw Hill Book Co. 2d edition. Cloth (6 × 9 inches), 501 pages and 184 line cuts. (Price : $4.00.)

[016 .385. 05]

II. — PERIODICALS.

In French.

Annales des ponts et chaussées. (Paris.)

1926 625 .174 (.44) & 721 .9 (.44)

Ann. des ponts et ch., part. techn., sept.-oct., p. 117.

MERLE (P.). — **Protection des voies ferrées contre la neige.** Dispositions générales. — Note sur un système de pare-neige en béton armé établi sur l'embranchement de Charpal. (4 300 mots & fig.)

1926 691

Ann. des ponts et ch., part. techn., sept.-oct., p. 196.

FÉRET. — Recherches faites à l'étranger sur la **composition rationnelle des bétons.** (4 000 mots.)

Bulletin de la Société d'encouragement pour l'industrie nationale. (Paris.)

1926 656 .254

Bull. de la Soc. d'enc. pr l'ind. nat., juill.-août-sept., [p. 564.

JULLIEN (L.). — Les applications pratiques de la **téléphonie sans fil.** Diffusion, postes fixes et postes mobiles, navires, avions, chemins de fer, téléphonie hertzienne sur fil. (10 700 mots & fig.)

1926 621 .33 (.44)

Bull. de la Soc. d'enc. pr l'ind. nat., octobre, p. 647.

MAUREAU (A.). — Etat actuel de la **traction électrique par accumulateurs** en France. (3 000 mots.)

Bulletin de la Société des ingénieurs civils de France. (Paris.)

1926 669 .1

Bull. de la Soc. des ing. civ. de France, juill.-août, p. 519.

GUILLET (L.). — Nouveau procédé de **durcissement superficiel des aciers par nitruration.** (1 200 mots & fig.)

1926 536 & 669 .1

Bull. de la Soc. des ing. civ. de France, juill.-août, p. 524.

GALIBOURG (J.). — Recherches sur les **phénomènes thermo-électriques et leurs applications en métallurgie.** (6 500 mots, 1 tableau & fig.)

1926 625 .251

Bull. de la Soc. des ing. civ. de France, juill.-août, p. 669.

DROSNE (P.). — **Le freinage continu** des trains de chemins de fer. (12 300 mots & fig.)

Bulletin technique de la Suisse romande. (Vevey.)

1926 625 .172 (.494)

Bull. techn. de la Suisse romande, n° 21, 9 oct., p. 249.

SCHENK (P.). — **Désherbage des voies de chemin de fer.** (1 600 mots & fig.)

1926 621 .331 (.494)

Bull. techn. de la Suisse romande, n° 23, 6 nov., p. 273.

La sous-station automatique de redresseur et commutatrice de Saint-Légier des Chemins de fer électriques veveysans. (2 400 mots & fig.)

1926 385 .113 (.494)

Bull. techn. de la Suisse romande, n° 24, 20 nov., p. 293.

Le budget d'exploitation et le compte de profits et pertes pour 1927 comparés à ce qu'ils seraient si aucune partie du réseau des Chemins de fer fédéraux n'avait été électrifiée et que toute la traction doive se faire à la vapeur. (2 200 mots & 4 tableaux.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1926 313 .385 (.494)

Bull. des transp. intern. par ch. de fer, sept., p. 309.

Statistique des chemins de fer suisses pour les années 1923 et 1924. (300 mots & tableau.)

1926 385 .113 (.436)

Bull. des transp. intern. par ch. de fer, oct., p. 343.

Résultats de l'exploitation des chemins de fer de la République tchécoslovaque en 1922. (250 mots.)

1926 313 .385 (.492)

Bull. des transp. intern. par ch. de fer, nov., p. 367.

Statistique des chemins de fer néerlandais pour l'année 1924. (500 mots.)

Bulletin de l'Union internationale des chemins de fer (Paris).

1926 385 .113 (.489)

Bull. de l'Union intern. des ch. de fer, août, p. 233.

Les chemins de fer du Danemark pendant l'exercice du 1er avril 1924 au 31 mars 1925. (2 200 mots & 7 tableaux.)

1926 313 .385 (.3)

Bull. de l'Union intern. des ch. de fer, août, p. 239.

Statistique internationale des chemins de fer. Année 1925. (1 800 mots & tableaux.)

1926 385 .113 (.44)

Bull. de l'Union intern. des ch. de fer, sept.-oct., p. 274.

Les résultats de l'exploitation des cinq grandes compagnies françaises de chemins de fer en 1925. (13 200 mots & tableaux.)

1926 385 .113 (.44)

Bull. de l'Union intern. des ch. de fer, sept.-oct., p. 299.

Résultats obtenus en 1925 sur les réseaux des cinq grandes Compagnies des chemins de fer français. (Nord, Est, Orléans, Paris-Lyon-Méditerranée et Midi). (8 tableaux.)

1926 385 .113 (.43)

Bull. de l'Union intern. des ch. de fer, sept.-oct., p. 303.

La première année d'exploitation de la Compagnie des chemins de fer allemands. (12 000 mots, 1 tableau & fig.)

1926 385 .113 (.494)

Bull. de l'Union intern. des ch. de fer, sept.-oct., p. 319.

Les Chemins de fer fédéraux suisses pendant l'exercice 1925. (3 600 mots & 4 tableaux.)

Chronique des transports. (Paris.)

1926 385 .113 (.44)

Chronique des transports, n° 20, 25 octobre, p. 9.

Les résultats d'exploitation des Chemins de fer d'Alsace et de Lorraine en 1925. (1 600 mots.)

Génie civil. (Paris.)

1926 62. (01 & 721 .9

Génie civil, n° 2303, 2 octobre, p. 278.

ROGOFF (A.). — **Calcul simplifié et pratique de la flexion simple et composée des pièces en béton armé.** (1 800 mots, 3 tableaux & fig.)

1926 624. (01

Génie civil, n° 2303, 2 octobre, p. 288.

Résultats d'essais effectués sur des ponts métalliques en Russie. (250 mots & fig.)

1926 656 .253 (.44)

Génie civil, n° 2304, 9 octobre, p. 297.

NETTER (J.). — **La signalisation des voies ferrées** par signaux lumineux employés jour et nuit. (1 700 mots & fig.)

1926 625 .258 (.73) & 656 .259 (.73)

Génie civil, n° 2305, 16 octobre, p. 326.

NETTER (J.). — **Rails-freins ou ralentisseurs de wagons** sur les voies de triage. (3 300 mots, 1 tableau & fig.)

1926 624 .6 (01

Génie civil, n° 2306, 23 octobre, p. 357.

LÉGENS (L.). — **Nouveau procédé de calcul de l'arc à treillis** à membrures paraboliques et muni d'un tirant. (900 mots & fig.)

1926 .721 .9 (.492)

Génie civil, n° 2307, 30 octobre, p. 365.

DANTIN (Ch.). — **Le chevalement en béton armé** du puits de Maurits aux houillères de l'Etat hollandais. (2 000 mots & fig.)

1926 621 .39

Génie civil, n° 2307, 30 octobre, p. 385.

La soudure de la fonte par l'arc électrique. (900 mots.)

1926 625 .2 (01

Génie civil, n° 2308, 6 novembre, p. 402.

PUICA (G.) & KERAVAL (J.). — **Nouvel accélérographe manométrique. Appareil pour la mesure des vibrations** produites par les véhicules. (2 500 mots & fig.)

1926 62. (01 & 625 .143.

Génie civil, n° 2309, 13 novembre, p. 425.

FREMONT (C.). — **Contribution à l'étude de l'usur ondulatoire des rails.** (2 000 mots & fig.)

1926 656 .222.

Génie civil, n° 2310, 20 novembre, p. 457.

ROUSSEL (A.). — **La capacité de circulation de chaussées et des voies ferrées.** (3 000 mots, 1 tablea & fig.)

1926 621 .335 (.52

Génie civil, n° 2311, 27 novembre, p. 469.

Electrification des Chemins de fer de l'Etat japonais Les nouvelles locomotives électriques Westinghouse (1 800 mots & fig.)

1926 62. (0

Génie civil, n° 2311, 27 novembre, p. 472.

DUPONT (P.). — **Le calcul des anneaux dynamométriques.** (3 600 mots & fig.)

Les chemins de fer et les tramways. (Paris.)

1926 621 .132.

Les ch. de fer et les tramw., novembre, p. 187.

MAINCENT (J.). — **Les résultats économiques qu l'on peut attendre de l'emploi des automotrices sur le grands réseaux.** (4 700 mots.)

1926 625 .25

Les ch. de fer et les tramw., novembre, p. 191.

Dispositif de réglage automatique pour timonerie (600 mots & fig.)

L'Industrie des voies ferrées et des transports automobiles. (Paris.)

1926 656 .231 (.44

L'Ind. voies ferrées et transp. autom., octobre, p. 448

THÉVENEZ (R.). — **Etude complémentaire sur les relèvements de tarifs des grands réseaux de chemins d fer.** (3 200 mots & 5 tableaux.)

1926 625 .61

L'Ind. voies ferrées et transp. autom., octobre, p. 452

SCHOPFER (J.). — **De l'emploi simultané du frei nage à air et du freinage rhéostatique.** (2 500 mots 1 tableau & fig.)

1926 625 .17

L'Ind. voies ferrées et transp. autom., octobre, p. 473

Le désherbage des voies ferrées. (1 000 mots & 1 ta bleau.)

Revue générale des chemins de fer. (Paris.)

1926 625 .13 (.44

Revue générale des ch. de fer, novembre, p. 355.

HACHON. — **La station de ventilation du tunnel d Mornay.** (5 500 mots, 1 tableau & fig.)

1926 625 .143.

Revue générale des ch. de fer, novembre, p. 370.

SABOURET. — **Auto-trempe & écrouissage superfi ciels des rails en service.** (11 400 mots & fig.)

1926 385. (06 (.4)

Revue générale des ch. de fer, novembre, p. 394.

Décisions de l'**Union internationale des chemins de fer** concernant le matériel roulant. (5 300 mots & fig.)

Revue politique et parlementaire. (Paris.)

1926 656 .23 (.44)

Revue politique et parlementaire, 10 octobre, p. 138.

ALLIX (G.). — **Le relèvement des tarifs des chemins de fer.** (3 700 mots.)

1926 385 .15 (.493)

Revue politique et parlementaire, 10 novembre, p. 202.

PESCHAUD (M.). — **La réorganisation des Chemins de fer de l'Etat belge.** (10 700 mots.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1926 625 .4

Archiv für Eisenbahnwesen, Heft 6, Nov.-Dez., S. 1300.

RISCH. — **Wirtschaftlich günstigste Höhenlage von Strassen und Eisenbahnen** bei der Ueberschreitung von Tälern und Höhen. (3 200 Wörter u. Abb.)

1926 385. (09.3 (.54)

Archiv für Eisenbahnwesen, Heft 6, Nov.-Dez., S. 1320.

VOIGT (G.). — **Studien zur britisch-indischen Eisenbahnpolitik.** (4 500 Wörter u. 2 Tabellen.)

1926 313 .385 (.495)

Archiv für Eisenbahnwesen, Heft 6, Nov.-Dez., S. 1333.

ZIEBARTH. — **Die griechischen Staatsbahnen** im Jahr 1924-25. (750 Wörter u. Tabellen.)

1926 385 .113 (.47)

Archiv für Eisenbahnwesen, Heft 6, Nov.-Dez., S. 1376.

Die **Staatseisenbahnen Lettlands** im Betriebsjahr 1924-25. (1 500 Wörter u. Tabellen.)

1926 313 .385 (.92)

Archiv für Eisenbahnwesen, Heft 6, Nov.-Dez., S. 1407.

Die Eisenbahnen in Niederländisch-Ostindien in den Jahren 1924 und 1925. (1 400 Wörter.)

1926 313 .385 (.498)

Archiv für Eisenbahnwesen, Heft, 6, Nov.-Dez., S. 1411.

Verkehrsstatistik der rumänischen Staatsbahnen für 1924. (Tabellen.)

In English.

Bulletin, American Railway Engineering Association. (Chicago.)

1926 624. (02 (.73) & 691 (.73)

Bull. Amer. Ry. Eng. Ass^{on}, August, p. 1.

Committee VII. — **Wooden bridges and trestles.** Trading rules and classification of timber and lumber for railway uses. (19 000 words & tables.)

1926 691. (02

Bull. Amer. Ry. Eng. Ass^{on}, August, p. 76.

Committee XVII. — **Wood preservation.** (16 500 words & fig.)

Electric Railway Journal. (New York.)

1926 625 .611

Electric Railway Journal, No. 6, August 7, p. 215.

POND (O. L.). — **Advantages of the indeterminate permit.** (4 700 words.)

1926 621 .331

Electric Railway Journal, No. 7, August 14, p. 257.

POWERS (R. E.). — **Application of automatically controlled equipment to substations.** (4 600 words & fig.)

1926 621 .338 (.71)

Electric Railway Journal, No. 8, August 21, p. 293.

Four-door single ended car for Montreal. (2 900 words, 1 table & fig.)

1926 621 .335 (.73)

Electric Railway Journal, No. 8, August 21, p. 297.

New theories in truck design for **electric cars** being tried. (1 300 words & fig.)

1926 625 .214 (.43)

Electric Railway Journal, No. 8, August 21, p. 300.

SCHULZE (E.). — **Causes of hot journal bearings.** (1 700 parole & fig.)

Engineer. (London.)

1926 625 .13

Engineer, No. 3679, July 16, p. 67.

KENT (C. G.). — **The timbering of trenches, shafts and tunnels.** (4 200 words & fig.)

1926 51. (08 (.42)

Engineer, No. 3684, August 20, p. 206.

A new circular slide rule. (1 200 words & fig.)

1926 669 .1

Engineer, No. 3685, August 27, p. 226.

HATFIELD (W. H.). — « **Ghost** » **lines in steel forgings.** (1 400 words.)

1926 621 .132.8 (.946)

Engineer, No. 3685, August 27, p. 230.

Petrol rail coaches for Tasmania. (1 600 words & fig.)

1926 669 .1

The Metallurgist, Suppl. to the Engineer, No. 3685, [August 27, p. 113.

« **Ghosts** ». (14 500 words & fig.)

1926 621 .116 (.42)

Engineer, No. 3686, September 3, p. 256.

Burning gasified coal. (1 400 words & fig.)

1926 62. (01

Engineer, No. 3687, September 10, p. 275.

HONDA (K.). — **Comparison of static and dynamic tensile and notched-bar tests.** (2 600 words, 4 tables & fig.)

1926 621 .3 (04 (.494)
Engineer, No. 3687, September 10, p. 283.
The **world power conference at Basle.** (5 200 words.)

1926 621 .134.3
Engineer, No. 3688, September 17, p. 310.
Locomotive valve gears. (1 200 words.)

1926 621 .87 (.44)
Engineer, No. 3688, September 17, p. 315.
A **200-ton floating crane.** (600 words & fig.)

1926 621 .331 (.73)
Engineer, No. 3689, September 24, p. 340.
The **Narrows power plant** of the Virginian Railway Company. (2 400 words & fig.)

1926 621 .133.2
The Metallurgist, supplement to Engineer, No. 3689, [September 24, p. 141.
Locomotive fire-box stay bolts. (800 words.)

Engineering. (London.)

1926 62. (01 & 669 .1
Engineering, No. 3158, July 23, p. 93.
Stress and strength. (900 words & 1 table.)

1926 621 .335 (.73) & 621 .43 (.73)
Engineering, No. 3159, July 30, p. 150.
Baldwin-Westinghouse 1 000 H. P. **Diesel electric locomotive.** (1 200 words & fig.)

1926 656 .212.6 (.42)
Engineering, No. 3160, August 6, p. 162.
Great Western Railway **coal loading plant** at Port Talbot. (2 200 words & fig.)

1926 621 .95 (.944)
Engineering, No. 3160, August 6, p. 164.
Drilling machines for Sydney harbour bridge contract. (900 words & fig.)

1926 656 .211.7 (.42)
Engineering, No. 3160, August 6, p. 167.
Ferry boat with Gill hydraulic propeller. (1 100 words & fig.)

1926 721 .1 (.73)
Engineering, No. 3161, August 13, p. 187.
SKINNER (F. W.). — **Pile-driving and concreting methods** on a large substructure contract. (3 400 words & fig.)

1926 621 .132.3 (.43)
Engineering, No. 3161, August 13, p. 198.
High-pressure **three-cylinder compound express locomotive.** (1 600 words & fig.)

1926 62. (01 & 669
Engineering, No. 3162, August 20, p. 242.
LEA (F. C.) & BUDGEN (H. P.). — **Combined torsional and repeated bending stresses.** (2 400 words, 1 table & fig.)

1926 625 .245 (.42
Engineering, No. 3163, August 27, p. 263.
40-ton well wagon for the London Midland & Scottish Railway. (900 words & fig.)

Engineering News-Record. (New York.)

1926 624 .2 (.73
Engineering News-Record, No. 2, July 8, p. 68.
Rigid-frame girder span in mountain highway bridge. (600 words & fig.)

1926 725 .4 (.73
Engineering News-Record, No. 3, July 15, p. 88.
SEELYE (E. E.). — **Truck and bus service station** at Long Island City. (3 200 words & fig.)

1926 625 .143
Engineering News-Record, No. 3, July 15, p. 93.
Rail joint practice on foreign railways. (1 600 words & fig.)

1926 624 .7 (.73
Engineering News-Record, No. 4, July 22, p. 135.
Concrete girder bridge has steel pin bearings. (600 words & fig.)

1926 656 .211.4 (.73) & 725 .31 (.73
Engineering News-Record, No. 4, July 22, p. 136.
Union station on the Southern Ry. at Greensboro N. C. (2 500 words & fig.)

1926 625 .13 (.73
Engineering News-Record, No. 5, July 29, p. 183.
Spectacular bridge job on Merced river in California (800 words & fig.)

1926 625 .143.4 (.73
Engineering News-Record, No. 5, July 29, p. 189.
Thin shims used to **improve worn rail joints.** (400 words & fig.)

1926 625 .143.3 (.73
Engineering News-Record, No. 5, July 29, p. 192.
New report on **transverse-fissure rail failures.** (1 200 words.)

1926 69
Engineering News-Record, No. 6, August 5, p. 214.
LEVENS (A. S.). — Tests show **how calcium chloride affects concrete.** (1 300 words, tables & fig.)

1926 625 .258 (.44) & 656 .259 (.44
Engineering News-Record, No. 6, August 5, p. 226.
Electric track brake for gravity switching in France (1 000 words & fig.)

1926 69
Engineering News-Record, No. 7, August 12, p. 258.
WITKIN (Z.). — **Concrete strength** made uniform by careful proportioning. (1 800 words, 1 table & fig.)

1926 62. (01 & 621 .3
Engineering News-Record, No. 7, August 12, p. 263.
Welded steel members and joints tested at Pittsburgh. (1 900 words & fig.)

1926 625 .111 (.73)
Engineering News-Record, No. 8, August 19, p. 306.
Four-track diversion built by Pennsylvania R. R. (1 000 words & fig.)

1926 62. (01 & 669
Engineering News-Record, No. 9, August 26, p. 332.
Endurance testing of metals — new developments. (1 900 words, 1 table & fig.)

1926 656 .213 (.73)
Engineering News-Record, No. 9, August 26, p. 334.
Rail and river terminal at Cincinnati, Ohio. (700 words & fig.)

1926 625 .142.2 & 691
Engineering News-Record, No. 9, August 26, p. 336.
MACLEAN (J. D.). — **Percentage renewals and average life of railway ties.** (2 600 words, 1 table & fig.)

1926 624 .63 (.73)
Engineering News-Record, No. 9, August 26, p. 342.
WOOD (C. H.). — **Curved arch spans** in long concrete bridge. (1 000 words & fig.)

1926 624 .7 (.73)
Engineering News-Record, No. 9, August 26, p. 350.
HIRSCHTHAL (M.). — **Equivalent uniform loads** for track concentrations. (700 words & fig.)

Locomotive Railway Carriage & Wagon Review. (London.)

1926 621 .132.3 (.944)
Loc. Ry. Carr. & Wag. Review, September 15, p. 273.
Express passenger locomotive, New South Wales Government Railways. (900 words & fig.)

1926 621 .132.8 (.43)
Loc. Ry. Carr. & Wag. Review, September 15, p. 279.
New turbine locomotive, Bavarian Section — German State Railways. (900 words, 1 table & fig.)

1926 625 .616 (.42)
Loc. Ry. Carr. & Wag. Review, September 15, p. 281.
The Howard **petrol locomotive.** (800 words, 1 table & fig.)

1926 621 .134.3
Loc. Ry. Carr. & Wag. Review, September 15, p. 296.
RIEKIE (J.). — **A new valve gear.** (1 200 words & fig.)

Modern Transport. (London.)

1926 621 .33 (.43)
Modern Transport, No. 388, August 21, p. 5.
Electrification of the German Railways. (1 000 words & 2 tables.)

1926 621 .132.7 & 621 .132.8
Modern Transport, No. 391, September 11, p. 4.
New type petrol-driven shunting locomotive. (1 200 words & fig.)

1926 625 .62 & 656 .1
Modern Transport, No. 391, September 11, p. 20.
BAKER (A.). — **Passenger transport by road.** (1 500 words & fig.)

1926 625 .232 (.44) & 656 .222 (.44)
Modern Transport, No. 392, September 18, p. 5.
Pullman car innovation on French railway. Calais-Paris « Golden arrow » trains. (1 900 words & fig.)

1926 621 .335 (.52)
Modern Transport, No. 392, September 18, p. 7.
ALBEN (F. A.) & PALMER (D. M.). — **Electrification** of the Japanese Railways. (1 500 words & fig.)

1926 621 .132.8 (.54)
Modern Transport, No. 393, September 25, p. 3.
The « **Garratt** » **locomotive** in India. (1 400 words & fig.)

1926 621 .335 (.42)
Modern Transport, No. 393, September 25, p. 5.
Electric locomotives for main line railways. (2 200 words & fig.)

1926 656
Modern Transport, No. 393, September 25, p. 7.
HARE (T. B.). — **Railway operation.** No. 1. — Introductory. (2 000 words.)

Proceedings, American Railway Association. (Signal Section.) (New York.)

1926 656 .256 (.73)
Amer. Ry. Ass^on^, Signal Section, October, p. 285.
ANDERSON (B. T.). — Some economic problems of **automatic block signaling a single-track railroad.** (5 000 words & fig.)

Railway Age. (New York.)

1926 625 .143.2 (.73)
Railway Age, No. 10, September 4, p. 408.
« **A** » **rails versus** increased discard. (900 words.)

1926 625 .13 (.73)
Railway Age, No. 10, September 4, p. 411.
HAGGANDER (G. A.). — **Hanging girder ends** from above eliminates necessity for piers. (2 100 words & fig.)

1926 385 .1 (.73)
Railway Age, No. 10, September 4, p. 415.
SHRIVER (G. M.). — Some **railroad problems.** (4 200 words & 1 table.)

1926 621 .331 (.73)
Railway Age, No. 10, September 4, p. 419.
The Virginian **power plant.** (2 100 words & fig.)

1926 621 .132.5 (.73)
Railway Age, No. 10, September 4, p. 431.
Three-cylinder **mountain type locomotive.** (1 400 words & fig.)

1926 625 .111 (.73)
Railway Age, No. 11, September 11, p. 451.
Grade crossing problem solved by building new line. (2 600 words & fig.)

1926 385 .517 (.73)
Railway Age, No. 11, September 11, p. 455.
COUNTY (A. J.). — **Improving human relations** in the transportation industry. (5 700 words.)

1926 621 .132.3 (.73)
Railway Age, No. 11, September 11, p. 461.
Pacific type locomotives for the Reading. (600 words, 1 table & fig.)

1926 656 .25 (06 (.73)
Railway Age, No. 11, September 11, p. 463.
Signal section meets in Los Angeles. (3 600 words.)

1926 621 .138.1 (.73)
Railway Age, No. 11, September 11, p. 469.
New **cinder handling plant** on the Peoria & Pekin Union. (700 words & fig.)

1926 621 .13 (06 (.73)
Railway Age, No. 12, September 18, p. 491.
Thirty-fourth **meeting of T. E. A.** (17 500 words & fig.)

1926 621 .131.1 (.73)
Railway Age, No. 12, September 18, p. 495.
WOODARD (W. E.). — **High horsepower output** cuts operating costs. (2 300 words & fig.)

1926 625 .143.4 (.73) & 621 .39 (.73)
Railway Age, No. 12, September 18, p. 505.
Welding battered joints has effected economies. (1 700 words, 1 table & fig.)

1926 656 .211.4 (.73)
Railway Age, No. 12, September 18, p. 507.
Railroads present plan for **terminals at Los Angeles.** (1 200 words & fig.)

1926 385 .51 (.73)
Railway Age, No. 12, September 18, p. 521.
WINSLOW (S. E.). — The new **railway labor act.** (2 000 words.)

1926 621 .33 (.73)
Railway Age, No. 13, September 25, p. 540.
STAPLES (E. I.). — Virginian completes **electrification.** (1 900 words & fig.)

1926 385 .587 (.73) & 657 (.73)
Railway Age, No. 13, September 25, p. 543.
Consolidation of **accounting departments saves money.** (3 400 words & fig.)

1926 625 .1 (06 (.73)
Railway Age, No. 13, September 25, p. 547.
Roadmasters hold 44th convention. (17 000 words.)

1926 621 .14 (.73) & 656 .261 (.7
Railway Age, No. 13, September 25, p. 588.
Motor Transport Conference meets. (3 000 wor & fig.)

1926 621 .14 & 656 .2
Railway Age, No. 13, September 25, p. 591.
RAYMOND (H. W.). — **Tractors and trailers** me test in terminal service. (900 words & fig.)

1926 621 .14 (.73) & 656 .1 (.7
Railway Age, No. 13, September 25, p. 595.
Pennsylvania trucks speed up service. (2 500 wor & fig.)

Railway Engineer. (London.)

1926 62. (01 & 621 .133
Railway Engineer, September, p. 306.
Boiler barrel plates. (1 100 words & fig.)

1926 621 .9 (.4
Railway Engineer, September, p. 308.
New **machine tools** for railway workshops. (1 9 words & fig.)

1926 621 .132.8 (.494) & 621 .43 (.49
Railway Engineer, September, p. 311.
Diesel rail-cars on the Swiss Federal Railways. (2 0 words & fig.)

1926 656 .253 (.42
Railway Engineer, September, p. 315.
The re-signalling on the widened lines, Metropolita Railway. (2 000 words & fig.)

1926 625 .252 (.42
Railway Engineer, September, p. 319.
Automatic brake increaser for bogie goods wagon (150 words & fig.)

1926 621 .132.3 (.42) & 621 .132.5 (.42
Railway Engineer, September, p. 321.
New mixed-traffic locomotives for the London Mi land & Scottish Railway. (900 words & fig.)

Railway Engineering & Maintenance. (Chicago

1926 625 .143.1 (.73
Railway Engineering and Maintenance, Sept., p. 34
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ROGERS (L. B.). — **« White coal » runs the Spanish Northern.** (4 200 words & fig.)

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1926 621 .335 (.44)
Electric Railway Journal, No. 11, September 11, p. 408.
Paris uses **bevel gear drive** extensively. (2 500 words & fig.)

1926 621 .33
Electric Railway Journal, No. 12, September 18, p. **449.**
LAKE (J. T.). — Many variables affect energy consumption by **electric railways.** (2 000 words & fig.)

1926 621 .335 (.73)
Electric Railway Journal, No. 12, September 18, p. 451.
WHITTAKER (C. C.). — **Rigid frames feature electric locomotives** for Virginian Railway. (1 700 words & fig.)

1926 621 .33 (09.1 (.73)
Electric Railway Journal, No. 13, September 25, p. 487.
STANLEY (J. J.). — Performance is the keynote of **Cleveland railway's success.** (3 400 words & fig.)

1926 621 .33 (09.1 (.73)
Electric Railway Journal, No. 13, September 25, p. 515.
FITZGERALD (T.). — Improvement continued in Pittsburgh with **modern equipment and methods.** (2 000 words, 5 tables & fig.)

1926 621 .33 (.485)
Electric Railway Journal, No. 17, October 23, p. 767.
NEITHAMMER (F.). — **Stockholm-Göteborg electrification** recently completed. (1 100 words & fig.)

1926 621 .335 (.73)
Electric Railway Journal, No. 18, October 30, p. 797.
KATTE (E. B.). — **New electric freight locomotive** placed in service by New York Central. (1 900 words, 1 table & fig.)

Engineer. (London.)

1926 621 .133.7 (.42) & 621 .9 (.42)
Engineer, No. 3690, October 1, p. 370.
Two new **scaling tools.** (450 words, 2 tables & fig.)

1926 656 .212.6 (.42)
Engineer, No. 3691, October 8, p. 385.
New hydraulic-electric coal hoists at Cardiff. (3 900 words & fig.)

1926 621 .13 (06 (.42)
Engineer, No. 3691, October 8, p. 396.
Institution of **locomotive engineers.** (1 800 words & fig.)

1926 621 .132.5 (.438)
Engineer, No. 3691, October 8, p. 398.
Decapod locomotive for Poland. (500 words & fig.)

1926 621 .132.3 (.42)
Engineer, No. 3692, October 15, p. 419.
A new **express locomotive.** (1 400 words.)

1926 624 .63 (.42)
Engineer, No. 3693, October 22, p. 448.
SCOTT (W. L.). — **Killermont bridge,** Glasgow. (1 500 words & fig.)

1926 621 .87 (.73) & 656 .212.6 (.73)
Engineer, No. 3694, October 29, p. 469.
A large **coal-shipping machine** or car dumper. (3 100 words & fig.)

1926 656 .211.7 (.82)
Engineer, No. 3694, October 29, p. 477.
The **twin-screw motor train ferry** Dolores de Urquiza. (1 000 words & fig.)

1926 624 .8 (.73) & 621 .39 (.73)
Engineer, No. 3694, October 29, p. 480.
Electric control equipment for a **bascule bridge.** (1 000 words & fig.)

1926 62. (01 & 669
The Metallurgist, p. 152, supplement to the Engineer, No. 3694, October 29.
HAGUE (A. P.). — **Corrosion fatigue.** (900 words & fig.)

1926 624 .8 (.42)
Engineer, No. 3695, November 5, p. 488.
Drawbridge at Kealby on the L. and N. E. Railway. (5 200 words & fig.)

1926 621 .116 & 669 .1
Engineer, No. 3695, November 5, p. 496.
PARR (S. W.) & STRAUB (F. G.). — The cause and prevention of embrittlement of **boiler plate.** (4 800 words, 11 tables & fig.)

1926 52 .69
Engineer, No. 3696, November 12, p. 522.
An **aerial mapping camera.** (1 200 words & fig.)

1926 621 .112. (01
Engineer, No. 3696, November 12, p. 534.
GUY (H. L.). — The economic value of increased **steam pressure.** (2 800 words, 3 tables & fig.)

1926 621 .132.3 (.42)
Engineer, No. 3697, November 19, p. 559.
Southern Railway **four cylinder express locomotive.** (1 400 words, tables & fig.)

Engineering. (London.)

1926 621 .132.5 (.73)
Engineering, No. 3164, September 3, p. 291.
4-12-2 type three-cylinder locomotive for the Union Pacific Railroad. (650 words & fig.)

1926 621 .116 (.42)
Engineering, No. 3164, September 3, p. 294.
The gasified-fuel system of burning pulverised coal. (2 300 words & fig.)

1926 62. (01 & 669 .1
Engineering, No. 3164, September 3, p. 309.
LUNDGREN (A.). — **Testing of hardened steel.** (4 100 words, 3 tables & fig.)

1926 62. (01 & 621 .83
Engineering, No. 3165, September 10, p. 316.
WRIGHT (W. E.). — The strength of **stub teeth.** (1 400 words, 1 table & fig.)

1926 669. (06 (.42)
Engineering, No. 3165, September 10, p. 317.
The **Institute of metals.** (9 900 words.)

1926 621 .3 (04 (.494)
Engineering, No. 3165, September 10, p. 333.
World-power conference sectional meeting. Bâle. (3 000 words.)

1926 621 .43
Engineering, No. 3166, September 17, p. 349.
The Worthington double-acting, two-stroke **Diesel engine.** (2 700 words & fig.)

1926 621 .33 (.42) & 625 .4 (.42)
Engineering, No. 3166, September 17, p. 355.
London Electric Railways extensions. (2 600 words.)

1926 669 .1
Engineering, No. 3166, September 17, p. 369.
PHRAGMÉN (G.). — The constitution of the **iron-silicon alloys.** (1 600 words & fig.)

1926 656 .213 (.42)
Engineering, No. 3167, September 24, p. 384.
The **Southampton docks extension :** Southern Railway. (550 words & fig.)

1926 388 (.42)
Engineering, No. 3167, September 24, p. 389.
London traffic. (2 200 words.)

1926 62. (01 & 669
Engineering, No. 3167, September 24, p. 398.
HONDA (K.). — A comparison of static and dynamic tensile and **notchedbar tests.** (1 900 words, 4 tables & fig.)

1926 62. (01 & 691
Engineering, No. 3167, September 24, p. 401.
MORTON (E.). — The microscopic determination of the **strength and durability of building stones.** (4 500 words & fig.)

1926 621 .133.7 (.42)
Engineering, No. 3168, October 1, p. 415.
The prevention of the **formation of boiler scale.** (1 300 words & fig.)

1926 721 .9 (.94)
Engineering, No. 3168, October 1, p. 416.
The Stobie **concrete pole.** (2 000 words & fig.)

1926 656 .28 (.42)
Engineering, No. 3168, October 1, p. 421.
British railway accidents. (1 500 words.)

1926 62. (01 & 669
Engineering, No. 3168, October 1, p. 429.
BULLEID (C. H.). — **Fatigue tests of cast ir**
(1 500 words & fig.)

1926 669
Engineering, No. 3168, October 1, p. 430.
BENEDICKS (C.) & SUNDBERG (R.). — Elect
chemical potentials of **carbon and chromium ste**
(3 500 words & fig.)

1926 621 .33 (.9
Engineering, No. 3168, October 1, p. 432.
The Sydney suburban **railway electrification.** (1
words & fig.)

1926 669
Engineering, No. 3169, October 8, p. 460.
JOHANSSON (A.) & SETH (R. von). — **Carburi**
tion and decarburisation of iron, and surface decarb
risation of steel. (5 600 words, tables & fig.)

Engineering News-Record. (New York.)

1926 624 .63 (.
Engineering News-Record, No. 10, September 2, p. 3
Six **concrete arch bridges** at the Twin Cities. (
words & fig.)

1926 725 .43 (.
Engineering News-Record, No. 10, September 2, p. 3
Steel-frame shop for machine-tool manufactu
(2 400 words & fig.)

1926 385. (01 (
Engineering News-Record, No. 10, September 10, p. 3
Railway developments in Africa show increas
needs. (700 words & fig.)

1926 625 .4 (.
Engineering News-Record, No. 11, September 9, p. 4
WHITE (L.). — **New York's third subway un**
construction. (2 000 words & fig.)

1926 625 .1 (.
Engineering News-Record, No. 11, September 9, p. 4
Pennsylvania R. R. builds **new freight cutoff.** (1
words & fig.)

1926 725 .4 (.
Engineering News-Record, No. 12, September 16, p. 4
KNEAS (F. N.). — Architectural development
the use of silicon steel in the Richmond power stati
(2 700 words, 2 tables & fig.)

1926 656 .213 (.73) & 721 .9 (.
Engineering News-Record, No. 12, September 16, p. 4
Ore-dock reconstruction on two different desig
(1 700 words & fig.)

1926 625 .13 (.
Engineering News-Record, No. 12, September 16, p. 4
BLOOD (H. F.). — **Old timber truss bridge** used
erecting **steel arch.** (1 200 words & fig.)

1926 624 .51 (.73)
ngineering News-Record, No. 13, September 23, p. 502.
COVELL (V. R.). — Erecting a self-anchored sus-nsion bridge. Seventh street bridge at Pittsburgh. 900 words & fig.)

1926 721 .1 (.73)
ngineering News-Record, No. 13, September 23, p. 506.
Piers sunk by varying air methods for New York otel. (1 400 words & fig.)

1926 691
ngineering News-Record, No. 13, September 23, p. 510.
GILES (R. T.). — Vary mix design for concrete to used at ages. (900 words & 3 tables.)

1926 624 .51 (.73)
ngineering News-Record, No. 14, September 30, p. 531.
Bridging the Delaware River at Philadelphia. (4 200 ords & fig.)

1926 625 .1 (.51)
ngineering News-Record, No. 14, September 30, p. 540.
STRINGER (H.). — Construction work on a Chinese ilway. (3 600 words & fig.)

1926 625 .13 (.73)
ngineering News-Record, No. 15. October 7, p. 568.
CHARM (L. M.). — New York's third subway under nstruction. (2 000 words & fig.)

1926 624 .63 (.73)
ngineering News-Record, No. 16, October 14, p. 619.
STRAUB (L. G.). — Concrete arch bridges support arifier mechanism. (700 words & fig.)

1926 621 .135.4 (.73) & 625 .144 (.73)
ngineering News-Record, No. 16, October 14, p. 620.
Terminal track layout as related to engine wheel-se. (1 400 words.)

1926 624 .63 (.73)
ngineering News-Record, No. 16, October 14, p. 621.
DEBUTTS (W. H.). — Novel methods used in build-g long concrete arch bridge. (1 800 words & fig.)

1926 625 .143.3 (.73)
ngineering News-Record, No. 17, October 21, p. 654.
Rail failures and axle loads on the P. & L. E. R. R. 00 words & fig.)

1926 625 .122 (.73) & 627 (.73)
ngineering News-Record, No. 17, October 21, p. 656.
ACHAUER (R. D.). — Hydraulic giants place slag ll from railway cars. (1 500 words & fig.)

1926 621 .39
ngineering News-Record, No. 17, October 21, p. 660.
CANDY (A. M.). — Development of arc welding of eel structures. (1 000 words & fig.)

1926 62. (01 & 721 .3
ngineering News-Record, No. 17, October 21, p. 662.
RETTGER (E. W.). — Add-area method for columns ith eccentric and lateral loads. (1 900 words & fig.)

1926 624 .8 (.73)
Engineering News-Record, No. 17, October 21, p. 666.
Bascule bridge with all mechanism below the deck. (3 200 words & fig.)

1926 532 (.73)
Engineering News-Record, No. 18, October 28, p. 692.
Novel design and construction features of estuary tunnel at Oakland. (3 700 words & fig.)

1926 656 .212.6 (.73)
Engineering News-Record, No. 18, October 28, p. 706.
Electric coal-car dumper handles 120-ton carloads. (3 200 words & fig.)

1926 62. (01 & 621 .392
Engineering News-Record, No. 18, October 28, p. 712.
MOSS (H. H.). — Tests of welded trusses and a new truss joint. (1 200 words, 1 table & fig.)

Locomotive Railway Carriage & Wagon Review. (London.)

1926 621 .132.1 (.436)
Loc. Ry. Carr. & Wag. Review, October 15, p. 318.
POULTNEY (E. C.) & KUPKA (J.). — Czecho-Slovakian State Railways Prairie type locomotives. (2 000 words & fig.)

1926 625 .232 (.66)
Loc. Ry. Carr. & Wag. Review, November 15, p. 359.
New boat train for Nigerian Rys. (1 100 words & fig.)

Mechanical Engineering. (New York.)

1926 621 .116. (01
Mechanical Engineering, October, p. 1017.
SPELLER (F. N.). — The problem of steam-boiler corrosion. (8 200 words & fig.)

1926 621 .133.7 (.73)
Mechanical Engineering, October, p. 1023.
JOHNSON (S. C.). — Water-treating problems encountered in railroad practice. (1 300 words.)

1926 621 .133.7 (.73)
Mechanical Engineering, October, p. 1024.
COUGHLAN (R. E.). — Progress of water treatment on railroads. (800 words & fig.)

1926 621 .335 & 621 .43
Mechanical Engineering, October, p. 1043.
Transmission of power on oil-engine locomotives. (4 500 words & fig.)

Modern Transport. (London.)

1926 625 .4
Modern Transport, No. 395, October 9, p. 15.
How a tube railway is constructed. (3 400 words & fig.)

1926 621 .132.3 (.42)
Modern Transport, No. 396, October 16, p. 3.
Most powerful locomotive in Great Britain. (1 100 words, 1 table & fig.)

1926 621 .138.2 (.42)
Modern Transport, No. 396, October 16, p. 8.
Locomotives coaled by electricity. (750 words & fig.)

1926 656 .257 (.42)
Modern Transport, No. 398, October 30, p. 3.
All-electric dynamic-indication system on London and North Eastern Railway. (1 700 words & fig.)

1926 656 .1 & 656 .2
Modern Transport, No. 398, October 30, p. 5.
Sir Ralph L. WEDGWOOD. — Methods to be adopted to meet **road competition**. (3 400 words & portrait.)

1926 656 .212 (.42) & 725 .32 (.42)
Modern Transport, No. 401, November 20, p. 3.
New freight terminal for Bristol. (2 500 words & fig.)

1926 385. (09.1 (.62)
Modern Transport, No. 401, November 20, p. 8.
Transport developments in the Sudan. (1 400 words & fig.)

Proceedings, American Society of Civil Engineers. (New York.)

1926 691
Proceed. Amer. Soc. Civil Eng., September, p. 1394.
YOUNG (R. B.). — Producing **concrete of uniform quality**. (6 400 words, 2 tables & fig.)

1926 691
Proceed. Amer. Soc. Civil Eng., September, p. 1407.
McMILLAN (F. R.) & WALKER (S.). — **Water-ratio specification for concrete**. (7 700 words, 3 tables & fig.)

1926 62. (01
Proceed. Amer. Soc. Civil Eng., September, p. 1423.
Unit stresses in structural materials. (9 700 words & fig.)

1926 388
Proceed. Amer. Soc. Civil Eng., September, p. 1444.
Increasing the efficiency of **passenger transportation in city streets**. (14 500 words, 1 table & fig.)

1926 62. (01
Proceed. Amer. Soc. Civil Eng., September, p. 1470.
NISHKIAN (L. H.) & STEINMAN (D. B.). — **Moments in restrained and continuous beams** by the method of conjugate points. (5 000 words & fig.)

1926 691
Proceed. Amer. Soc. Civil Eng., September, p. 1505.
WILLIAMS (G. M.) & DRAFFIN (J. O.). — **Corrosion of concrete**. (2 400 words, 6 tables & fig.)

1926 691
Proceed. Amer. Soc. Civil Eng., September, p. 1521.
WHEELER (W. H.). — Report of the Joint Committee on **standard specifications for concrete and reinforced concrete**. (1 100 words.)

1926 62. (01 & 721 .9
Proceed. Amer. Soc. Civil Eng., October, p. 1713.
GODFREY (E.) & SANDBECK (H. C.). — **Distribution of reinforcing steel** in concrete beams and sl (3 300 words & fig.)

1926 62.
Proceed. Amer. Soc. Civil Eng., October, p. 1731.
MILLER (L. H.) & KENNEY (E. F.). — **U stresses in structural materials. A symposium.** (3 words.)

1926 62. (01 & 624.
Proceed. Amer. Soc. Civil Eng., October, p. 1737.
DUFOUR (F. O.). — Final report of the special co mittee of **impact in highway bridges**. (1 100 words fig.)

Proceedings, Institution of Civil Engineers. (London.)

1926 621
Proceed. Inst. of Civ. Eng., Selected engineering pape No. 33, p. 3.
WALKER (W. J.). — A standard cycle for all ty of **internal-combustion motor**. (4 700 words, 1 ta & fig.)

1926 385. (09.1 (.6
Proceed. Inst. of Civ. Eng., Selected engineering pape No. 35, p. 3.
PINCKNEY (F. G. A.). — **Sudan Government Ra ways and Steamers**. (4 900 words & fig.)

1926 669
Proceed. Inst. of Civ. Eng., Selected engineering pape No. 42, p. 3.
RANG (E. J.). — **Some properties of mild steel**, wi special reference to its behaviour at high temperatur (2 900 words, tables & fig.)

Railway Age. (New York.)

1926 621 .138.1 (.73) & 725 .33 (.7
Railway Age, No. 14, October 2, p. 623.
An effective combination of **new and old roundhous** (3 900 words & fig.)

1926 621 .7 (.73) & 621 .9 (.7
Railway Age, No. 14, October 2, p. 629.
HALL (M. A.). — **Modern shop equipment** as a fa tor in increased production. (4 300 words.)

1926 656 .254 (.7
Railway Age, No. 14, October 2, p. 633.
Telegraph & telephone section. (3 900 words & fig

1926 385 .3 (
Railway Age, No. 14, October 2, p. 637.
ELDER (A. H.). — Tendencies in **railway legislatio** (2 600 words.)

1926 621 .132.3 (.7
Railway Age, No. 14, October 2, p. 641.
Pacific type locomotives for the A. & W. P. and V of A. (500 words & fig.)

1926 621 .134.1 (.73)
Railway Age, No. 14, October 2, p. 642.
The Martyn balanced **piston head.** (600 words & fig.)

1926 621 .139 (.73), 625 .18 (.73) & 625 .27 (.73)
Railway Age, No. 15, October 9, p. 665.
The **C. M. & St. Paul budgets its purchases.** (4 000 words & fig.)

1926 621 .133.7 (.73)
Railway Age, No. 15, October 9, p. 675.
STURDEVANT (C. W.). — Southern Pacific **softens water by Zeolite method.** (1 700 words & 1 table.)

1926 625 .232 (.73)
Railway Age, No. 15, October 9, p. 685.
All-steel coaches for the A. C. L. (700 words & fig.)

1926 625 .252 (.73)
Railway Age, No. 15, October 9, p. 689.
Improved **truck lever connection.** (400 words & fig.)

1926 656 .212.6 (.73)
Railway Age, No. 16, October 16, p. 716.
WHITE (R. M.). — **Electric trucks** at D. L. & W. car float freight stations. (1 300 words & fig.)

1926 385. (09.3 (.73)
Railway Age, No. 16, October 16, p. 722.
Centenary of the Granite Railway. (1 700 words & fig.)

1926 625 .232 (.73)
Railway Age, No. 16, October 16, p. 735.
New Haven buys six **dining cars.** (900 words & fig.)

1926 621 .335 (.73)
Railway Age, No. 16, October 16, p. 736.
Storage battery locomotive with gas-electric auxiliary. (1 000 words.)

1926 614 .5 (.73)
Railway Age, No. 17, Section 1, October 23, p. 755.
VAN HOVENBERG (H. W.). — **Malaria** is no longer menace on the cotton belt. (4 900 words & fig.)

1926 621 .139 (.73), 625 .18 (.73) & 625 .27 (.73)
Railway Age, No. 17, Section 1, October 23, p. 761.
Atlantic Coast Line finds profit in **reclaiming materials.** (3 200 words, tables & fig.)

1926 656 .253 (.73)
Railway Age, No. 17, Section 1, October 23, p. 773.
Union Pacific uses **train control** successfully on 25 miles. (3 300 words, 2 tables & fig.)

1926 625 .245 (.73)
Railway Age, No. 17, Section 1, October 23, p. 778.
New **hopper cars** for the C. & E. I. (500 words & fig.)

1926 656 .1 (.73) & 656 2 (.73)
Railway Age, No. 17, Section 2, October 23, p. 801.
Bus service installed by Norfolk Southern. (2 200 words & fig.)

1926 656 .1 (.73) & 656 .2 (.73)
Railway Age, No. 17, Section 2, October 23, p. 811.
What the **motor transport** investigation has shown. (4 700 words & fig.)

1926 625 .214 (.73)
Railway Age, No. 18, October 30, p. 835.
St. Paul places order for **roller bearing equipment.** (2 700 words & fig.)

1926 625 .111 (.73) & 656 .211 (.73)
Railway Age, No. 18, October 30, p. 841.
New York Central plans elaborate **station for Buffalo, N. Y.** (3 000 words & fig.)

1926 621 .335 (.73)
Railway Age, No. 18, October 30, p. 845.
KATTE (E. B.). — New York Central **electric freight locomotives.** (1 800 words & fig.)

1926 625 .13 (.73)
Railway Age, No. 19, November 6, p. 878.
BETTS (C. A.). — Work on **Moffat tunnel** forging ahead. (2 000 words & fig.)

1926 656 .229 (.73)
Railway Age, No. 19, November 6, p. 883.
KELTON (Major E. C.). — **Railroad capacity** and national defense. (3 500 words.)

1926 625 .26 (01
Railway Age, No. 19, November 6, p. 889.
KRUEGER (A. J.). — **Freight car inspection.** (2 100 words.)

1926 621 .132 (.43)
Railway Age, No. 19, November 6, p. 897.
Standard locomotives for the German State Railways. (1 500 words, 1 table & fig.)

Railway Engineer. (London.)

1926 625 .143.5 (.42)
Railway Engineer, October, p. 340.
An improved **rail anchor.** (750 words & fig.)

1926 625 .232 (.4)
Railway Engineer, October, p. 341.
New Pullman cars for continental service. (1 600 words & fig.)

1926 621 .132.5 (.42)
Railway Engineer, October, p. 351.
2-8-0 type locomotives, Somerset & Dorset Joint Railway. (200 words & fig.)

1926 621 .132.3 (.68)
Railway Engineer, October, p. 353.
New mixed-traffic locomotive for Rhodesia. (700 words & fig.)

1926 621 .131.2
Railway Engineer, October, p. 355.
Areas of steam ports. (1 000 words & fig.)

1926 621 .132.8 (.47) & 621 .335 (.47)
Railway Engineer, October, p. 357.
Diesel locomotives for main line traffic. (2 700 words & fig.)

Railway Engineering & Maintenance. (Chicago.)

1926 625 .17 (.73)
Railway Engineering & Maintenance, November, p. 446.
What is being done in the way of **track maintenance in winter?** (5 900 words & fig.)

1926 625 .144.4
Railway Engineering & Maintenance, November, p. 477.
Effect of oiling roadbed on the efficiency of the **ballast.** (900 words.)

1926 625 .144.4 (.73)
Railway Engineering & Maintenance, November, p. 482.
A new machine for **cleaning ballast.** (800 words & fig.)

1926 62. (01 (.52) & 625 .143.3 (.52)
Railway Engineering & Maintenance, December, p. 503.
A **transverse fissure detector.** (1 400 words & fig.)

Railway Gazette & Railway News. (London.)

1926 625 .232 (.44)
Railway Gazette & News, No. 10, September 3, p. 276.
Pullman cars for continental service. (1 500 words & fig.)

1926 621 .136 (.73)
Railway Gazette & News, No. 10, September 3, p. 281.
Large **locomotive tenders.** (700 words.)

1926 621 .87 (.42) & 656 .212.6 (.42)
Railway Gazette & News, No. 11, September 10, p. 302.
Mechanical equipment of Cardiff docks. (800 words & fig.)

1926 625 .258 (.73) & 656 .259 (.73)
Railway Gazette & News, No. 11, September 10, p. 312.
An automatic **wagon retarder.** (350 words & fig.)

1926 625 .232 (.44) & 656 .222.5 (.44)
Railway Gazette & News, No. 12, September 17, p. 328.
De luxe travel on the Nord Railway of France. (1 400 words & fig.)

1926 621 .33 (.42) & 625 .4 (.42)
Railway Gazette & News, No. 12, September 17, p. 332.
Morden extension line, Kennington loop and Associated works, **London Electric and « City » Railways.** (4 700 words & fig.)

1926 385 .11 (.42)
Railway Gazette & News, No. 12, September 17, p. 345.
The outlook for **home railway stocks.** (4 000 words & 8 tables.)

1926 621 .132.7 (.42)
Railway Gazette & News, No. 13, September 24, p. 365.
New **shunting locomotive,** Great Western Railway. (250 words & fig.)

1926 621 .132.8 (.940
Railway Gazette & News, No. 13, September 24, p. 36
Drewry rail motor-cars for Tasmania. (500 wor & fig.)

1926 621 .331 (.5
Railway Gazette & News, No. 13, September 24, p. 36
Control gear for **railway automatic sub-statio** (800 words & fig.)

1926 385 .4 (.4
Railway Gazette & News, No. 13, September 24, p. 37
French railway organisation. (1 700 words.)

1926 625 .616 (.66) & 625 .617 (.6
Railway Gazette & News, No. 14, October 1, p. 395.
Internal-combustion locomotive and passenger car f British Guiana. (500 words & fig.)

1926 625 .143.5 (.4
Railway Gazette & News, No. 14, October 1, p. 397.
An improved **rail anchor.** (700 words & fig.)

1926 621 .335 (.49
Railway Gazette & News, No. 14, October 1, p. 398.
Electric motor coaches for the Loetschberg Railwa (800 words & fig.)

1926 656 .212.5 (.4
Railway Gazette & News, No. 15, October 8, p. 418.
Marshalling yard design in the reconstructed are of the Northern Railway of France. (2 200 wor & fig.)

1926 654 (.4
Railway Gazette & News, No. 15, October 8, p. 421.
A modern **printing telegraph system.** (1 000 wor & fig.)

1926 621 .132.3 (.4
Railway Gazette & News, No. 16, October 15, p. 454.
New four-cylinder 4-6-0 type express locomotiv Southern Railway. (1 000 words & fig.)

1926 621 .132.3 (.4
Railway Gazette & News, No. 16, October 15, p. 457.
New type of locomotive tender, Great Western Rai way. (300 words & fig.)

1926 621 .132.4 (.4
Railway Gazette & News, No. 16, October 15, p. 458.
New 0-6-0 type superheater locomotive, London North Eastern Railway. (350 words & fig.)

1926 621 .33 (.944
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Sydney suburban **railway electrification.** (1 400 word & fig.)

1926 625 .245 (.73
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1926 385 .4 (.54)
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Railway reorganisation in Ceylon. (200 words & table.)

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Baldwin 2-8-2 type locomotives for the Bikaner State Railway. (800 words & fig.)

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A new Ljungström **turbo-condensing locomotive.** (1 000 words & fig.)

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Light railway locomotive for potato traffic. (250 words & fig.)

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WHELAN (J. J.). — Short method tables for pricing **car repair bills.** (800 words & 1 table.)

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1926 69

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1926 **625 .235 (.492)**

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1926 **62. (0**

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1926 **621 .335 & 621 .4**

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1926 **624**

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1927 **625 .21**

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[016 .385 (02]

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1927 62. (01 & 625 .143.2

Génie civil, n° 2320, 29 janvier, p. 118.

PICHARD (L.). — **La fissuration interne des rails avec tache ovale. Hypothèse sur sa formation.** (4 700 mots & fig.)

1927 624 .5 (01

Génie civil, n° 2320, 29 janvier, p. 123.

CAUFOURIER (P.). — **Etude économique des grands ponts suspendus par J. A. L. WADDELL.** (1 500 mots & fig.)

1927 624 .63 (.485)
Génie civil, n° 2321, 5 février, p. 152.
Viaduc en béton armé sur l'Ore (Suède). (800 mots & fig.)

Les chemins de fer et les tramways. (Paris.)

1927 621 .335
Les ch. de fer et les tramw., janvier, p. 2.
SPIESS (E.). — **Locomotive électrique** à marchandises de 3 320 H. P. du New York Central Railroad. (2 000 mots & fig.)

1927 625 .225
Les ch. de fer et les tramw., janvier, p 10.
Système de construction de voitures métalliques. (1 500 mots & fig.)

1927 625 .142.4
Les ch. de fer et les tramw., janvier, p. 14.
Disposition nouvelle de traverses tronçonnées. (800 mots & fig.)

1927 625 .151
Les ch. de fer et les tramw., janvier, p. 15.
Changement de voie sans ralentissement. (700 mots & fig.)

L'Industrie des voies ferrées et des transports automobiles. (Paris.)

1926 621 .33 (.44) & 625 .62 (.44)
L'Ind. voies ferrées et transp. autom., décembre, p. 557.
VERGNE (L.). — **Emploi de trains de 9 voitures** au maximum dont 2 motrices sur le réseau des T. C. R. P. (5 600 mots & fig.)

1926 388
L'Ind. voies ferrées et transp. autom., décembre, p. 572.
JAYOT. — Répartition de la population. Peuplement. **Vitesse et capacité des transports.** (27 000 mots, tableaux & fig.)

Revue générale des chemins de fer. (Paris.)

1927 625 .251
Revue générale des chemins de fer, janvier, p. 29.
POULLAIN (L.). — **Essais de freinage** avec le frein à puissance auto-variable, système « Chamon ». (4 900 mots & fig.)

1927 656 .212.5
Revue générale des chemins de fer, janvier, p. 64.
Indication des voies de débranchement dans les gares de triage. (2 000 mots & fig.)

1927 625 .13 (.73)
Revue générale des chemins de fer, janvier, p. 67.
Renforcement d'un pont métallique de la rivière Columbia (Etats-Unis). (850 mots & fig.)

Revue politique et parlementaire. (Paris.)

1927 621 .33 (.44)
Revue politique et parlementaire, 10 janvier, p. 146.
ALLIX (G.). — **Où en est l'électrification des chemins de fer français?** (4 900 mots.)

Revue universelle des transports. (Paris.)

1926 625 .143.2
Revue universelle des transports, 25 septembre, p. 61.
La question des **aciers à rails** et le traitement thermique des usines de Neuves-Maisons. (700 mots.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1927 313 .385 (.3)
Archiv für Eisenbahnwesen, Heft 1, Jan.-Febr., S. 1.
AUERWALD. — **Die Eisenbahnen der Erde** im Jahr 1924. (500 Wörter u. Tabellen.)

1927 385 .14 (.434)
Archiv für Eisenbahnwesen, Heft 1, Jan.-Febr., S. 8.
ADOLPH (E.). — Ruhrkohlenbergbau, **Transportwesen und Eisenbahntarifpolitik.** (15 500 Wörter u. Tabellen.)

1927 625 .611 (.431)
Archiv für Eisenbahnwesen, Heft 1, Jan.-Febr., S. 59.
Förderung des Baus von Kleinbahnen in Preussen durch die Provinzial- (Kommunal-) Verbände. (8 000 Wörter.)

1927 385 .113 (.43)
Archiv für Eisenbahnwesen, Heft 1, Jan.-Febr., S. 113.
Die Deutsche Reichsbahn-Gesellschaft in ihrem ersten Geschäftsjahr (1925). (600 Wörter u. Tabellen.)

1927 385 .113 (.492)
Archiv für Eisenbahnwesen, Heft 1, Jan.-Febr., S. 129.
Die Niederländischen Eisenbahnen im Jahr 1925. (1 700 Wörter u. Tabellen.)

1927 385. (09.1 (.436) & 385 .113 (.436)
Archiv für Eisenbahnwesen, Heft 1, Jan.-Febr., S. 138.
Die Eisenbahnen in der tschechoslowakischen Republik. (2 000 Wörter u. Tabellen.)

1927 313 .385 (.439)
Archiv für Eisenbahnwesen, Heft 1, Jan.-Febr., S. 153.
RAJZ (K.). — Die königlich ungarischen Staatsbahnen in den Betriebsjahren 1918/19-1923/24. (Tabellen.)

In English.

Electric Railway Journal. (New York.)

1926 625 .245 (.73)
Electric Railway Journal, No. 22, November 27, p. 956.
Making profitable **electric freight service** a reality. (1 800 words & fig.)

1926 621 .336 (.73)
Electric Railway Journal, No. 22, November 27, p. 965
BIRCH (L. W.). — High current capacity with **exceptional flexibility feature of catenary.** (1 700 words & fig.)

1926 388 (.73)
Electric Railway Journal, No. 24, December 11, p. 1036.
Co-ordinated transportation proposed for St. Louis. (4 700 words, 2 tables & fig.)

1927 621 .33 (.436)
Electric Railway Journal, No. 2, January 8, p. 79.
NIETHAMMER (F.). — **Electric railways** of Czechoslovakia. (2 700 words & fig.)

Engineer. (London.)

1926 656 .211.7 (.73)
Engineer, No. 3698, November 26, p. 576.
An American **train-ferry steamer.** (2 000 words & fig.)

1926 621 .132.8 (09 (.91)
Engineer, No. 3698, November 26, p. 580.
Fairlie-Perkins **super-pressure locomotive.** (1 300 words & fig.)

1926 621 .13 & 621 .335
Engineer, No. 3698, November 26, p. 587.
STONE (T. A. F.). — **Electric locomotives** : a method of classifying, analysing and comparing their characteristics. (3 400 words, 8 tables & fig.)

1926 669 .1
The Metallurgist, p. 174, supplement to the Engineer No. 3698, November 26.
The corrosion of **iron and steel.** (1 200 words & fig.)

1926 621 .87 (.68)
Engineer, No. 3699, December 3, p. 618.
Locomotive hoist for Port Elisabeth. (450 words & fig.)

1926 725 .36 (.493) & 721 .9 (.493)
Engineer, No. 3700, December 10, p. 633.
Reinforced concrete silos at the Ougrée-Marihaye steel works. (2 900 words & fig.)

1926 656 .257 (.42)
Engineer, No. 3700, December 10, p. 642.
The **re-signalling of Cambridge station.** (2 000 words & fig.)

1926 62. (01
Engineer, No. 3700, December 10, p. 645.
A new design of **recording torsionmeter.** (1 700 words & fig.)

1926 62. (01
Engineer, No. 3701, December 17, p. 672.
A **roof-stick bending machine.** (1 300 words & fig.)

1926 621 .132.3 (.73)
Engineer, No. 3702, December 24, p. 698.
POULTNEY (E. C.). — The **largest passenger locomotive.** (900 words, 1 table & fig.)

1926 669 .1
The Metallurgist, p. 186, supplement to the Engineer, No. 3703, December 31.
KIDANI (Y.) & SASAKI (R.). — On the change of temperature and magnetic induction of **steel in tension and compression tests.** (1 200 words, 1 table & fig.)

1926 62. (01
The Metallurgist, p. 188, supplement to the Engineer, No. 3703, December 31.
The **measurement of hardness.** (2 200 words & fig.)

Engineering. (London)

1926 621 .116. (01
Engineering, No. 3171, October 22, p. 495.
PETRIE (T.). — Some deductions from **steam-nozzles research.** (3 300 words & fig.)

1926 669 .3
Engineering, No. 3171, October 22, p. 520.
SMITH (C. S.) & HAYWARD (C. R.). — The action of hydrogen on **hot solid copper.** (3 900 words, 1 table & fig.)

1926 62. (01
Engineering, No. 3172, October 29, p. 525.
TURNER (F. C.). — A **mechanical autographic extensometer.** (1 900 words & fig.)

1926 669
Engineering, No. 3172, October 29, p. 553.
ANDREW (J. H.) & DICKIE (H. A.). — A physical investigation into the **cause of temper-brittleness.** (2 200 words, 3 tables & fig.)

1926 656 .211.7 (.42)
Engineering, No. 3173, November 5, p. 557.
Landing stage improvements at Seacombe ferry. (4 000 words & fig.)

1926 656 .212.6 (.42)
Engineering, No. 3174, November 12, p. 589.
Coal-handling plant at the Gas Light and Coke Company's Beckton works. (1 900 words & fig.)

1926 52 .69
Engineering, N° 3174, November 12, p. 595.
Camera for **aerial surveying.** (2 800 words & fig.)

1926 691
Engineering, No. 3174, November 12, p. 617.
The permeability of **Portland cement concrete.** (1 500 words.)

1926 624 .63 (.436)
Engineering, No. 3175, November 19, p. 623.
Cast-iron concrete bridge at Gmünden, Austria. (1 200 words & fig.)

1926 625 .216 (.73)
Engineering, No. 3175, November 19, p. 631.
The Majex (M. C. B.) coupler transition device. (1 100 words & fig.)

1926 621 .112
Engineering, No. 3175, November 19, p. 643.
GUY (H. L.). — The economic value of increased **steam pressure.** (3 600 words, 2 tables & fig.)

1926 621 .9
Engineering, No. 3175, November 19, p. 647.
HORNER (F.). — **Alignment in machine tool practice.** (3 200 words & fig.)

1926 621 .112
Engineering, No. 3176, November 26, p. 649.
Recent experiments on the properties of steam at igh pressures. (3 000 words & fig.)

1926 621 .13 & 621 .335
Engineering, No. 3176, November 26, p. 669.
The Institution of Mechanical Engineers. (4 600 ords.)

1926 621 .335
Engineering, No. 3176, November 26, p. 674.
STONE (T. A. F.). — Electric locomotives. A method f classifying, analysing and comparing their character- stics. (2 700 words & fig.)

1926 62. (01 & 621 .9
Engineering, No. 3176, November 26, p. 679.
Torsion testing machine for fine wires. (600 words fig.)

1926 621 .112. (01
Engineering, No. 3177, December 3, p. 681.
Recent experiments on the properties of steam at igh pressures. (2 800 words & fig.)

1926 62. (01 & 669 .1
Engineering, No. 3179, December 17, p. 743.
MUIR (J.) & BINNIE (D.). — The overstraining of teel by bending. (2 900 words & fig.)

1926 625 .232
Engineering, No. 3179, December 17, p. 751.
Sleeping cars for the International Sleeping Car Com- any, Limited. (1 400 words & fig.)

1926 624 .51 (.73)
Engineering, No. 3181, December 31, p. 803.
Cable construction on the Bear Mountain bridge. 4 300 words & fig.)

1926 62. (01
Engineering, No. 3181, December 31, p. 807.
LEHMANN (G. D.). — The variation in the fatigue trength of metals when tested in the presence of dif- erent liquids. (2 600 words, 1 table & fig.)

1926 624 .5 (01
Engineering, No. 3181, December 31, p. 819.
The stiffness of suspension bridges. (1 700 words.)

1926 624 .5
Engineering, No. 3181, December 31, p. 827.
WADDELL (J. A. L.). — Quantities and costs of flooring for long-span suspension bridges. (6 000 words, tables & fig.)

Engineering News-Record. (New York.)

1926 624 .63 (.73)
Engineering News-Record, No. 19, November 4, p. 732.
KING (W. E.) & JONES (R. C.). — Engineering and architectural design of a long concrete bridge. (4 000 words & fig.)

1926 669 .1 (.73) & 691 (.73)
Engineering News-Record, No. 19, November 4, p. 738.
Technical problems of steel construction discussed by fabricators. (3 600 words.)

1926 621 .133.7 (.73)
Engineering News-Record, No. 20, November 11, p. 780.
DANIELSON (F. D.). — New water softening plant for Hinsdale, Illinois. (1 800 words, 1 table & fig.)

1926 62. (01 & 624 .63
Engineering News-Record, No. 20, November 11, p. 785.
GREENE (J. F.). — Some lessons learned in build- ing long concrete bridge. (3 000 words & fig.)

1926 625 .13 (.73)
Engineering News-Record, No. 20, November 11, p. 788.
Reinforcing a steel viaduct : Northern Pacific Ry. (2 700 words & fig.)

1926 624 .62 (.73)
Engineering News-Record, No. 20, November 11, p. 796.
Steel arch closure effected with aid of temperature changes. (400 words & fig.)

1926 721 .1 (.73)
Engineering News-Record, No. 21, November 18, p. 816.
Open foundation plant and methods on Manhattan Island. (4 100 words & fig.)

1926 625 .13 (.73)
Engineering News-Record, No. 22, November 25, p. 858.
Methods and progress in driving the 8-mile Great Northern tunnel in the Cascades. (4 600 words, 1 table & fig.)

1926 625 .13 (.73) & 691 (.73)
Engineering News-Record, No. 22, November 25, p. 865.
TEMPLE (H. H.). — Repairing old concrete lining on two-track railroad tunnel. (850 words & fig.)

1926 624 .8 (.73)
Engineering News-Record, No. 22, November 25, p. 868.
Erecting Dumbarton toll bridge on San Francisco Bay. (1 400 words & fig.)

1926 624 .63 (.73)
Engineering News-Record, No. 22, November 25, p. 874.
FELGATE (A. M.). — Modern bridge in Parkway System of Cleveland, Ohio. (1 250 words & fig.)

1926 625 .142.3 (.68)
Engineering News-Record, No. 22, November 25, p. 876.
Steel ties for South African Government Railways. (700 words, 1 table & fig.)

1926 721 .1 (.73)
Engineering News-Record, No. 23, December 2, p. 898.
Foundation construction, New York Edison power plant. (3 200 words & fig.)

1926 624 .63 (.73)
Engineering News-Record, No 24, December 9, p. 942.
Concrete arch replaces viaduct at Portland, Ore. (1 400 words & fig.)

1926 624 .7 (.73)
Engineering News-Record, No. 24, December 9, p. 954.
HIRSCHTHAL (M.). — **High strength concrete** versus compressive reinforcement. (1 200 words.)

1926 624 .7 (.73)
Engineering News-Record, No. 24, December 9, p. 964.
Floor system drainage scheme for **concrete railway bridges.** (400 words & fig.)

1926 627 (.71) & 656 .213 (.71)
Engineering News-Record, No. 25, December 16, p. 984.
WILDER (A. D.). — Design and construction of **pier « B-C », Canadian Pacific Railway,** at Vancouver. (3 800 words & fig.)

1926 691
Engineering News-Record, No. 25, December 16, p. 990.
NICHOLSON (G. F.). — **Concrete piles** impregnated with **asphalt** for seawater use. (2 300 words & fig.)

1926 625 .13 (.73)
Engineering News-Record, No. 26, December 23, p. 1034.
Steel railroad bridge raised 21 ft. under traffic. (1 500 words & fig.)

1926 691. (01
Engineering News-Record, No. 26, December 23, p. 1040.
Reinforced concrete. — Its shortcomings as a material. (4 700 words.)

1926 624 .63 (.73)
Engineering News-Record, No. 27, December 30, p. 1080.
Defects in new **concrete bridge** and proposed repairs. (2 000 words & fig.)

1926 625 .142.2 (.73) & 691 (.73)
Engineering News-Record, No. 27, December 30, p. 1084.
Treated Douglas fir ties show strength unaffected. (550 words, 1 table & fig.)

1927 625 .13 (.73)
Engineering News-Record, No. 1, January 6, p. 8.
Highway bridge moved without interrupting traffic. (1 700 words & fig.)

Mechanical Engineering. (New York.)

1926 621 .131.1
Mechanical Engineering, November, p. 1095.
EKSERGIAN (R.). — Preliminary power rating and **tractive force of modern locomotives.** (6 600 words & fig.)

1926 62. (01 & 621 .83
Mechanical Engineering, November, p. 1105.
TIMOSHENKO (S.) & BAUD (R. V.). — The **strength of gear teeth.** (2 900 words, 3 tables & fig.)

1926 621 .116
Mechanical Engineering, November, p. 1115.
SHERMAN (R. A.) & RICE (W. E.). — Refractories service conditions in **furnaces burning Pittsburgh coal on chain grates.** (4 400 words, 3 tables & fig.)

1926 621 .116 & 621 .133.
Mechanical Engineering, November, p. 1129.
GREER (W. N.) & PARKER (H. C.). — The potentiometric determination of hydrogen- ion concentrations as applied to **boiler waters.** (3 000 words & fig.

1926 621 .9
Mechanical Engineering, November, p. 1135.
McKEAGE (J. A.). — Modern **sawing machinery** (5 800 words & fig.)

1926 621 .134.
Mechanical Engineering, Mid-November, p. 1195.
SCHMIDT (E. C.) & SNODGRASS (J. M.). — The use of **high steam pressure in locomotives.** (7 200 words 2 tables & fig.)

1926 621 .116. (0
Mechanical Engineering, Mid-November, p. 1217.
FIELDNER (A. C.). — The low-temperature **carbonization of coal.** (7 700 words & fig.)

1926 385 .4 (0
Mechanical Engineering, Mid-November, p. 1247.
CLARK (J. C.). — **Railroad organization.** (520 words.)

1926 621 .116. (0
Mechanical Engineering, Mid-November, p. 1361.
Joint Research Committee on **boiler-feedwater studies** (17 000 words.)

1926 621. (0
Mechanical Engineering, December, p. 1427.
Progress in **railroad maintenance engineering.** (4 20 words & 2 tables.)

1926 62. (01 & 621 .
Mechanical Engineering, December, p. 1435.
HALL (E. D.). — Modern developments in **inspection methods.** (5 300 words & fig.)

Modern Transport. (London.)

1926 388 (.42)
Modern Transport, No. 403, December 4, p. 10.
London traffic. Committee recommends co-ordination (3 300 words & fig.)

1927 621 .134.
Modern Transport, No. 407, January 1, p. 5.
Locomotive development. Need for higher working pressures. (1 500 words.)

1927 656 .25 (.43)
Modern Transport, No. 409, January 15, p. 3.
LASCELLES (T. S.). — **Railway signalling** in Germany. (2 900 words & fig.)

1927 621 .33 (.485)
Modern Transport, No. 410, January 22, p. 3.
Railway electrification in Sweden. The Stockholm-Gothenburg line. (1 600 words & fig.)

Proceedings, American Society of Civil Engineers. (New York.)

1926 624 .51
roceed. Amer. Soc. Civil Eng., November, p. 1761.
WADDELL (J. A. L.). — Quantities of materials nd costs per square foot of floor for highway and lectric railway long-span suspension bridges. (7 200 ords, 2 tables & fig.)

1926 691
roceed. Amer. Soc. Civil Eng., November, p. 1813.
Corrosion of concrete. (9 300 words, 2 tables & fig.)

1926 388 (.73)
roceed. Amer. Soc. Civil Eng., November, p. 1837.
THOMSON (T. K.). — Increasing the efficiency of assenger transportation in city streets. (4 500 words fig.)

1926 62. (01 & 691
roceed. Amer. Soc. Civil Eng., November, p. 1847.
Distribution of reinforcing steel in concrete beams nd slabs. (6 200 words & fig.)

1926 62. (01 & 721 .3
roceed. Amer. Soc. Civil Eng., November, p. 1889.
SALMON (E. H.). — Progress report of the Special ommittee on steel column research. (2 000 words.)

1926 62. (01 (.73) & 721 .9 (.73)
roceed. Amer. Soc. Civil Eng., December, p. 1979.
ZESIGER (A. W.) and AFFELDT (E. J.). — tresses in helically reinforced concrete columns. (2 300 ords.)

1926 691 (.73)
roceed. Amer. Soc. Civil Eng., December, p. 1995.
BINGER (W. D.). — Corrosion of concrete. (1 600 ords & fig.)

Railway Age. (New York.)

1926 625 .142.2 (.73) & 691 (.73)
ilway Age, No. 20, November 13, p. 923.
WOODS (R. P.). — New timber treating plant serves uthwestern Railroad. (1 500 words & fig.)

1926 656 .212.8 (.73)
ilway Age, No. 20, November 13, p. 925.
An improved deck for a scale pit. (900 words & fig.)

1926 621 .132.5 (.71)
ilway Age, No. 20, November 13, p. 931.
Canadian National builds two Mikado locomotives. 00 words, 1 table & fig.)

1926 62. (01 (.73)
ilway Age, No. 20, November 13, p. 937.
BAXTER (G. L.). — Purchasing materials and sup- es on specification. (1 900 words & fig.)

1926 656 .215 (.73)
ilway Age, No. 21, November 20, p. 972.
JOHNSON (G. T.). — Lighting of classification rds. (2 300 words & fig.)

1926 627 (.71) & 656 .213 (.71)
Railway Age, No. 21, November 20, p. 980.
Canadian Pacific builds new pier at Vancouver, B. C. (4 300 words & fig.)

1926 621 .132.3 (.73)
Railway Age, No. 21, November 20, p. 989.
Mountain type locomotives for the Pennsylvania. (1 900 words, 1 table & fig.)

1926 621 .33 (.73)
Railway Age, No. 22 (Section one), Nov. 27, p. 1029.
Electric traction on the Great Northern. (2 600 words & fig.)

1926 625 .232 (.73)
Railway Age, No. 22 (Section one), Nov. 27, p. 1041.
Private car has new heating and ventilation features. (1 500 words & fig.)

1926 656 .254 (.73)
Railway Age, No. 22 (Section one), Nov. 27, p. 1051.
PEABODY (J. A.). — C. & N. W. replaces highway crossing gates with Wig-Wags. (1 000 words, 1 table & fig.)

1926 656 .1 (.73) & 656 .2 (.73)
Railway Age, No. 22, November 27, p. 1072.
THOM (A. P.). — Public interest demands bus and truck regulation. (5 200 words & fig.)

1926 656 .1 (.73) & 656 .2 (.73)
Railway Age, No. 22, November 27, p. 1083.
CUNNINGHAM (W. J.). — Co-ordinated rail-highway service. (3 900 words.)

1926 656 .212 (.73) & 725 .32 (.73)
Railway Age, No. 23, December 4, p. 1097.
B. & O. and Reading open joint produce terminal. (3 300 words & fig.)

1926 656 .223.2 (.73)
Railway Age, No. 23, December 4, p. 1103.
SILLCOX (L. K.). — Factors in the use of freight cars. (6 200 words, 1 table & fig.)

1926 625 .1 (.73)
Railway Age, No. 24, December 11, p. 1147.
Southern Pacific builds alternate main line in Arizona. (4 200 words & fig.)

1926 385 .571 (.73)
Railway Age, No. 24, December 11, p. 1153.
Mechanical engineers in the railroad industry. (2 300 words, 11 tables & fig.)

1926 621 .132.5 (.73)
Railway Age, No. 24, December 11, p. 1161.
2-8-4 locomotives for the Illinois Central. (900 words, 1 table & fig.)

1926 385. (09.1 (.42 + .73)
Railway Age, No. 25, December 18, p. 1203.
BELL (R.). — Railway progress in Great Britain and America. (6 900 words.)

1926 625 .245 (.73)
Railway Age, No. 25, December 18, p. 1209.
C. & N. W. buys 70-ton steel ore cars. (700 words, 1 table & fig.)

1926 621 .134.3
Railway Age, No. 25, December 18, p. 1222.
SCHMIDT (E. C.) & SNODGRASS (J. M.). — High pressure in locomotives. (2 800 words, 1 table & fig.)

1926 625 .13 (.73)
Railway Age, No. 26, Section one, December 25, p. 1247.
Great Northern builds longest railway tunnel in America. (5 600 words & fig.)

1926 621 .132.5 (.73)
Railway Age, No. 26, Section one, December 25, p. 1265.
Union Pacific type locomotive performance. (1 200 words, 1 table & fig.)

1926 621 .13 (09.1 (.73)
Railway Age, No. 26, Section one, December 25, p. 1268.
WOODARD (W. E. W.). — Western Railway Club has unusual program. (3 900 words & fig.)

1926 625 .213 (.73)
Railway Age, No. 26, Section one, December 25, p. 1272.
Loop brake beam suspension. (600 words & fig.)

1926 625 .245 (.73)
Railway Age, No. 26, Section one, December 25, p. 1273.
70-ton hopper cars for D. L. & W. (1 000 words & fig.)

1926 656 .1 & 656 .2
Railway Age, No. 26, Section two, December 25, p. 1290.
The pro and con of railroad bus operation. (3 900 words.)

Railway Engineer. (London.)

1926 621 .33 (.42) & 625 .4 (.42)
Railway Engineer, November, p. 373.
The new Morden extension and Kennington loop lines. (4 800 words & fig.)

1926 621 .138.2 (.42)
Railway Engineer, November, p. 385.
New mechanical coaling and sanding plant at Doncaster. (900 words & fig.)

1926 621 .132.5 (.43)
Railway Engineer, November, p. 389.
Heavy freight locomotives for the German Railways. (700 words & fig.)

1926 621 .335 (.73)
Railway Engineer, November, p. 393.
Oil-electric shunting locomotive of 100 tons weight for the Long Island Railroad, U. S. A. (1 000 words & fig.)

1926 621 .132.3 (.42)
Railway Engineer, November, p. 395.
New four-cylinder 4-6-0 locomotive, Southern Railway. (1 000 words & fig.)

1926 621 .131.
Railway Engineer, November, p. 398.
Horse-power and adhesion of locomotives. (500 word & fig.)

1926 62. (01 (.43) & 669 .1 (.43
Railway Engineer, November, p. 399.
Railway metallurgy in Germany. (700 words & 3 ta bles.)

1926 385. (09.1 (.42
Railway Engineer, December, p. 409.
A new colliery line in Yorkshire. (1 900 word & fig.)

1926 625 .232 (.66
Railway Engineer, December, p. 417.
New boat trains for the Nigerian Railways. (1 10 words & fig.)

1926 625 .245 (.42
Railway Engineer, December, p. 420.
80-ton trolley wagon, L. M. S. R. (400 words & fig.

1926 656 .253 (.42
Railway Engineer, December, p. 423.
Signalling of the Watford branch, Metropolitan an London & North Eastern joint line. (1 300 word & fig.)

1926 621 .132.8 (.42
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A new Ljungström turbo-condensing locomotive (1 100 words & fig.)

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The Buenos Ayres Great Southern Railway. (6 800 words, 1 table & fig.)

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[016 .385 (02]

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d'un barème des distances entre elles des 350 principales stations et de leur distance aux 50 points frontières;

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JOYANT (E.). — Le chemin de fer sur route est ne erreur. (6 500 mots & fig.)

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1927 621 .43
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BUCHI (A.). — Moteurs Diesel avec balayage et alimentation par turbo-soufflante à gaz d'échappement. (2 700 mots & fig.)

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Exécution d'un tunnel sous-fluvial à l'abri d'une dalle continue en béton armé. Traversée de la Sprée par le Métropolitain électrique de Berlin. (2 700 mots & fig.)

1927 62. (01

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WOLKOWITSCH (D.). — **Généralisation pour un profil quelconque des résultats de l'expérience du professeur C. Bach.** (4 300 mots & fig.)

1927 624 .63 (.73)

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Pont en béton de Fort Smelling, sur le Minnesota (Etats-Unis). (1 000 mots & fig.)

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CHAUDY (F.). — **Les conditions d'application de la théorie des pièces prismatiques chargées de bout et la formule de Rankine.** (1 300 mots & fig.)

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1927 624 .5 (09.3 (.44)

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LEINEKUGEL LE COCQ. — **Le pont suspendu, d'invention française, vient d'avoir 100 ans.** (4 200 mots & fig.)

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1927 625 .615

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1927 621 .131.2

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SPIESS (E.). — **Etude théorique et pratique des caractéristiques principales d'une locomotive à vapeur moderne.** (3 700 mots, 4 tableaux & fig.)

1927 625 .172

Les ch. de fer et les tramw., février, p. 30.

Désherbeuse pour voies ferrées. (500 mots & fig.)

1927 62. (01 & 669. (01

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AUDO. — **Quelques fabrications de pièces de fonte pour matériel de chemins de fer.** (Cylindres à vapeur et segments.) (4 400 mots, tableaux & fig.)

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1927 625 .13 (.73)

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DE VOOGHT (R. L.). — **Le Holland Tunnel.** Hudson River vehicular tunnel. (6 900 mots & fig.)

1927 385. (01 (.675)

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La transformation du **Chemin de fer du Bas-Congo** et l'état actuel des travaux. (3 200 mots, 1 tableau & fig.)

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1927 625 .232 (.4

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VALLANCIEN (J.). — **Voitures métalliques** 3e **classe à bogies, pour grandes lignes étudiées par l'O**fice Central d'études de matériel de chemins de fe (2 000 mots & fig.)

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BIRCKEL (R.). — **Note concernant les déplacemen en courbe des bogies par rapport au châssis dans** matériel du type à deux bogies. (8 100 mots & fig.)

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1927 656 .256.3 (.7

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1927 621 .131

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Le stroboscope à grand éclairage de MM. Laurent Augustin Seguin, son application dans l'industrie d chemins de fer. (1 200 mots & fig.)

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MARNEFFE (A. de). — **Note sur l'influence** l'écrouissage sur la **résistance des barres en acier.** (8 mots, 1 tableau & fig.)

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Recherche des **fissures dans les essieux et les engr** nages par la méthode magnétique. (350 mots.)

1926 621 .3

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1926 621 .138 (.73) & 725 .33 (.73

Bull. Amer. Ry. Eng. Assn, November, p. 73.

Report of Committee XXIII. **Shops and locomotiv terminals.** (6 700 words & 1 table.)

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Report of Committee II — **Ballast.** (1 400 words.)

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Report of Committee XVIII — **Electricity and of the** lectric Section — American Railway Association. 5 300 words, tables & fig.)

1926 692 (.73)
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Report of special Committee on **standardization.** 7 500 words & fig.)

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FARRIN (J. M.). — Economics of **railway track.** 3 000 words & fig.)

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1927 388 (.73)
lectric Railway Journal, No. 4, January 22, p. 154.
Billion-dollar plan for **Chicago transit.** (1 500 words, tables & fig.)

1927 621 .335 (.73)
lectric Railway Journal, No. 4, January 22, p. 165.
High-speed articulated cars for Washington, Baltiore & Annapolis Electric Railroad. (1 300 words & ig.)

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EWING (D. D.). — Co-ordinated **study of rail cor**ugation made in Europe. (1 700 words.)

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FREMONT (Ch.). — Effect of abrasion and compression on **rail corrugation.** (1 800 words & fig.)

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1927 621 .132
ngineer, No. 3704, January 7, p. 3.
Locomotives of 1926. (5 000 words & fig.)

1927 621 .138.5 (.73)
ngineer, No. 3706, January 21, p. 67.
Repairs to locomotives of American design. (3 900 words.)

1927 621 .95 (.54)
ngineer, No. 3707, January 28, p. 106.
Double-spindle connecting-rod **drilling machine.** (600 words & fig.)

1927 621 .94 (.42)
ngineer, No. 3707, January 28, p. 110.
Portable crank pin **turning and grinding machine.** 400 words & fig.)

1927 621 .132.8 (.42)
Engineer, No. 3708, February 4, p. 118.
The Reid-MacLeod **steam turbine locomotive.** (2 800 words & fig.)

1927 625 .234 (.44) & 625 .245 (.44)
Engineer, No. 3708, February 4, p. 134.
Steam-boiler wagon for **heating electric trains.** (850 words & fig.)

1927 621 .138.2 (.42)
Engineer, No. 3709, February 11, p. 163.
Pneumatic coal and ash conveying plant. (3 700 words & fig.)

1927 624 .8 (.42)
Engineer, No. 3710, February 18, p. 177.
Swing bridges at Beccles and St. Olave's. (2 900 words & fig.)

1927 621 .91 (.42)
Engineer, No. 3710, February 18, p. 191.
A large electrically driven **planing machine.** (3 800 words & fig.)

1927 624 .51 (.73)
Engineer, No. 3711, February 25, p. 202.
Delaware River **suspension bridge,** U. S. A. (2 900 words & fig.)

1927 621 .39
The Metallurgist, p. 19, supplement to the Engineer, No. 3711, February 25.
Autogenous and electric welding of cast iron. (1 800 words & fig.)

1927 669 .1
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Temper brittleness. (1 500 words, 1 table & fig.)

1927 62. (01
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INGLIS (N. P.). — **Hysteresis and fatigue of the Wöhler rotating cantilever** specimen. (2 300 words, 2 tables & fig.)

1927 62. (01
The Metallurgist, p. 27, supplement to the Engineer, No. 3711, February 25.
The law of similarity in **notched bar impact testing.** (1 100 words, 1 table & fig.)

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1927 621 .331 (.68)
Engineering, No. 3182, January 7, p. 11.
The supervisory **control of sub-stations.** (8 200 words & fig.)

1927 656 .223.2 (.42)
Engineering, No. 3182, January 7, p. 19.
Defects in **traders' trucks.** (1 700 words.)

1927 656 .211.5 (.42)
Engineering, No. 3183, January 14, p. 38.
Moving stairways on the London Underground Railways. (2 600 words & fig.)

1927 621 .336 (.42) & 625 .4 (.42)
Engineering, No. 3183, January 14, p. 56.
COOPER (A. R.). — **Electrical equipment of track** on the Underground Railways of London. (4 900 words, 1 table & fig.)

1927 621 .87
Engineering, No. 3183, January 14, p. 60.
FIEGEHEN (E. C.). — The power plant of a **locomotive steam crane.** (2 700 words.)

1927 624 .32 (.62)
Engineering, No. 3185, January 28, p. 96.
The Dessouk **railway bridge,** Egypt. (2 000 words & fig.)

1927 624 .8 (.73)
Engineering, No. 3185, January 28, p. 121.
Double deck bascule railway bridge, New York. (400 words & fig.)

1927 621 .86 (.42)
Engineering, No. 3186, February 4, p. 133.
Shallow-type **railway-carriage traverser.** (900 words & fig.)

1927 625 .232 (.4)
Engineering, No. 3186, February 4, p. 144.
Pullman dining cars for the International Sleeping Car Company, Limited. (1 500 words & fig.)

1927 62. (01 & 669 .1
Engineering, No. 3187, February 11, p. 155.
JEVONS (J. D.). — **Stress distribution in mild steel** as indicated by special etching. (4 800 words & fig.)

1927 656 .211.7 (.81)
Engineering, No. 3187, February 11, p. 166.
The **double-ended ferry steamer « Imbuhy ».** (1 700 words & fig.)

1927 621 .134.3
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The **high-pressure steam locomotive.** (2 000 words.)

1927 62. (01
Engineering, No. 3188, February 18, p. 201.
Statically indeterminate structures. (1 900 words.)

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1927 656 .211.7 (.52) & 656 .213 (.52)
Engineering News-Record, No. 4, January 27, p. 158.
NAWA (M.). — New **railway train-ferry** in Japan. (1 000 words & fig.)

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Engineering News-Record, No. 5, February 3, p. 185.
British tunneling practice for rapid-transit lines. (1 000 words & fig.)

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SLACK (S. B.). — **Cantilever bridge** replaces o wooden lattice. (900 words & fig.)

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GILKEY (H. J.). — Water gain and allied phen mena in **concrete work.** (1 900 words & fig.)

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Engineering News-Record, No. 7, February 17, p. 28
GEREND (M. S.). — Steamed-cured cylinders gi **28-day concrete strength in 48 hours.** (1 500 wor & fig.)

1927 624 .62 (.7
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Great **steel arch bridge** planned for New York ha bor. (1 200 words & fig.)

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1927 385. (09 .1 (.4
Great Western Ry. Magazine, January, p. 4.
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CRAWFORD (J. M.) & HALL (R. V.). — **Prese vation of wooden poles.** (12 700 words, 1 table & fig

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LEDGER (W. H.). — **Safe load** for an unsymmet cally loaded column. (3 900 words & fig.)

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POOLE (W.). — **Limes and cements.** (22 000 wor 18 tables & fig.)

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1927 656 .211.7 (.4
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GIBSON (A. L.). — **The L. & N. E. R. services** Harwich. (10 000 words.)

1927 385
Journal of the Institute of Transport, January, p. 1
BELL (R.). — **State control of transport.** (12 0 words.)

1927 385 .4 (.4
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LEWIS (R. P.). — The divisional system of ra **way organisation.** (5 800 words.)

1927 656 .212 (.42)
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LAMPITT (F. W.). — The Great Western Railway ods depot at Bristol. (7 700 words.)

1927 656 .226 (.42)
urnal of the Institute of Transport, February, p. 189.
CROZIER (W.). — Parcels traffic by railways. 900 words.)

urnal, Permanent Way Institution. (London.)

1926 625 .152 & 625 .162
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DONSON (J. H.). — Level crossings and gates. (2 600 ords & fig.)

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GUERITTE (T. J.) & BRYCE (T. H.). — Repair- g and strengthening of metallic bridges by means of rro-concrete. (3 600 words & fig.)

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JACQUET (A.). — « Type 10 » express locomotives, elgian National Railway Company. (2 300 words & g.)

1927 621 .132 (.439)
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LASSEUR (E.). — Hungarian State Railway loco- notives. (1 400 words, 1 table & fig.)

1927 621 .132.3 (.86)
oc. Ry. Carriage & Wagon Review, February 15, p. 35.
New Kitson-Meyer type locomotives for Columbia. 1 300 words & fig.)

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1927 621 .116. (01
Mechanical Engineering, January, p. 1.
LANDER (C. H.). — Recent developments in the cience of coal utilization. (9 500 words, 5 tables & fig.)

1927 385 .587
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DE LEEUW (A. L.). — The change of viewpoint of he machine shop. (3 200 words.)

1927 62. (01 & 621 .39
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GREENE (T. W.). — Stresses in a large welded tank ubjected to repeated high test pressures. (4 500 words, tables & fig.)

1927 62. (01 & 621 .93
Mechanical Engineering, February, p. 139.
BOSTON (O. W.). — A research in the elements of netal cutting. (5 300 words, 2 tables & fig.)

1927 385. (07.1 (.73)
Mechanical Engineering, February, p. 147.
Opportunities afforded the mechanical engineer in the railroad and railroad-supply industries. (5 000 words, 12 tables & fig.)

1927 621 .1 (01
Mechanical Engineering, February, p. 160.
Progress in steam research. (3 900 words & fig.)

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1927 621 .131
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POULTNEY (E. C.). — Locomotive performance. (1 800 words & fig.)

1927 621 .335 (.43) & 625 .245 (.43)
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Self-propelled electric rail vehicle. (600 words & fig.)

1927 385. (09.1 (.44)
Modern Transport, No. 413, February 12, p. 5.
CAHILL (J. R.). — Railway developments in France. (2 600 words.)

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1927 656 .257 (.73)
Amer. Ry. Ass^on^, Signal Section, February, p. 379.
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1927 656 .251 (.73)
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Committee VI. — Designs. (2 800 words & fig.)

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Committee IV. — Direct current automatic block signaling. (2 600 words.)

1927 656 .25 (01 (.73)
Amer. Ry. Ass^on^, Signal Section, February, p. 442.
Committee V. — Instructions. (31 000 words & fig.)

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Amer. Ry. Ass^on^, Signal Section, February, p. 579.
Special Committee. — Highway crossing protection. (2 000 words & fig.)

1927 656 .256.3 (.73)
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1927 **62. (01**

Proceed. Amer. Soc. Civil Engineers, January, p. 3.

LE CONTE (J. N.). — **The stresses in a free prismatic rod** under a single force normal to its axis. (2 700 words & fig.)

1927 **625 .13 (.73)**

Proceed. Amer. Soc. Civil Engineers, February, p. 163.

KEAYS (R. H.). — Construction methods on the **Moffat Tunnel.** (16 000 words & fig.)

Railway Age. (New York.)

1927 **621 .33 (.73)**

Railway Age, No. 1, January 1, p. 54.

OEHLER (A. G.). — **Electric traction activities in** 1926. (3 000 words & fig.)

1927 **625 .141 (.73) & 691 (.73)**

Railway Age, No. 2, January 8, p. 174.

Pere Marquette begins **test of concrete roadbed.** (2 600 words & fig.)

1927 **656 .256.3 (.73)**

Railway Age, No. 2, January 8, p. 183.

Great Northern concludes extensive **signaling program.** (2 400 words, 1 table & fig.)

1927 **621 .134.3 (.73)**

Railway Age, No. 2, January 8, p. 196.

Use of **high steam pressure in locomotives.** (4 300 words, 1 table & fig.)

1927 **656 .212.5 (.73) & 725 .33 (.73)**

Railway Age, No. 3, January 15, p. 228.

DAYTON (C. A.). — **Lackawanna builds new yard** at East Binghampton, N. Y. (3 000 words & fig.)

1927 **656 .254 (.73)**

Railway Age, No. 3, January 15, p. 233.

PEABODY (J. A.). — Unique **crossing signals.** (750 words & fig.)

1927 **621 .132.5 (.73)**

Railway Age, No. 3, January 15, p. 251.

RIEGEL (S. S.). — Lackawanna buys twenty-five **three-cylinder locomotives.** (1 000 words, tables & fig.)

1927 **385 .581 (.73) & 625 .17 (.73)**

Railway Age, No. 4, Section one, January 22, p. 282.

Winter work stabilizes labor on the Delaware & Hudson. (2 800 words & fig.)

1927 **621 .134.5 (.73) & 625 .214 (.73)**

Railway Age, No. 4, Section one, January 22, p. 287.

Lubrication costs watched closely on A. C. L. (1 400 words, 1 table & fig.)

1927 **656 .253 (.7**

Railway Age, No. 4, Section one, January 22, p. 291.

Missouri Pacific operates **trains in either directi** on both tracks. (1 200 words & fig.)

1927 **621 .132.8 (.4**

Railway Age, No. 4, Section one, January 22, p. 295.

MELMS (G. J.). — **Turbine locomotive** for the Ge man State Railways. (3 000 words, 1 table & fig.)

1927 **656 .283 (.7**

Railway Age, No. 4, Section one, January 22, p. 303.

Report on Rockmart **collision.** (2 000 words & fig

1927 **656 .211.4 (.73) & 656 .211.6 (.7**

Railway Age, No. 4, Section two, January 22, p. 341.

STEINBERGER (M. F.). — How the B. & O. ope ates its unique **New York terminal service.** (4 000 wor & fig.)

1927 **621 .335 (.73) & 621 .4 (.7**

Railway Age, No. 5, January 29, p. 353.

Lehigh Valley installs **high power motor cars.** (2 7 words & fig.)

1927 **621 .335 (.73) & 621 .4 (.7**

Railway Age, No. 5, January 29, p. 369.

BASTON (C. E.). — **Electric locomotives** for t Great Northern. (1 400 words, 1 table & fig.)

1927 **625 .142.2 (06 (.73) & 691. (06 (.7**

Railway Age, No. 5, January 29, p. 377.

Wood Preservers urge greater use of **treated timbe** (3 900 words, 1 table & fig.)

1927 **656 .211.4 (.7**

Railway Age, No. 6, February 5, p. 411.

Pennsylvania plans **new passenger terminal at Phil** delphia. (4 200 words & fig.)

1927 **621 .138.2 (.7**

Railway Age, No. 7, February 12, p. 456.

Reading builds **unusual coaling station** at Ruthe ford, Pa. (2 200 words & fig.)

1927 **621 .39 (.73) & 625 .143.4 (.7**

Railway Age, No. 7, February 12, p. 476.

BOVARD (W. P.). — Applying power bonds b **welding.** (500 words & fig.)

Railway Engineer. (London.)

1927 **621 .138.5 (.82) & 725 .33 (.82**

Railway Engineer, January, p. 7.

The locomotive works of the Central Argentine Rai way at Perez. (2 400 words & fig.)

1927 **621 .335 (.81**

Railway Engineer, January, p. 17.

Electric passenger locomotive for the Paulista Rai way, Brazil. (1 500 words & fig.)

1927 621 .135.3
ilway Engineer, January, p. 35.
Laminated springs. (1 000 words & fig.)

1927 656 .257 (.42)
ilway Engineer, February, p. 46.
The re-signalling of Cambridge station, London & rth Eastern Railway. (2 700 words & fig.)

1927 624 .5 (09
ilway Engineer, February, p. 57.
The evolution of the suspension bridge. (5 100 words fig.)

1927 625 .143.2
ilway Engineer, February, p. 65.
A study of hot and cold rolled rails. (400 words fig.)

1927 656 .221
ilway Engineer, February, p. 73.
DENDY MARSHALL (C. F.). — Notes on train sistance. (4500 words, 3 tables & fig.)

1927 621 .7 (.931)
ilway Engineer, March, p. 85.
New workshops for the New Zealand Railways. 000 words & fig.)

1927 621 .7 (.82)
ilway Engineer, March, p. 91.
A large railway carriage and wagon works in South merica. (1 900 words & fig.)

1927 621 .131.2
ilway Engineer, March, p. 98.
CARDEW (C. A.). — Graphical methods of analys- g the anticipated performance of proposed locomotive sign. (1 600 words & fig.)

1927 625 .13 (.42)
ilway Engineer, March, p. 102.
Reconstruction and widening of the swing bridges Beccles and St. Olaves, London & North Eastern ilway. (1 600 words & fig.)

1927 621 .132.5 (.82)
ilway Engineer, March, p. 115.
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FREYSSINET (E.) & COYNE (A.). — Observations **une maladie des bétons de ciment fondu.** Précauns à prendre pour leur exécution. (3 300 mots, 1 tau & fig.)

1927 621 .112
nie civil, n° 2326, 12 mars, p. 269.
DANTIN (Ch.). — **L'emploi des hautes températures des hautes pressions dans les installations à vapeur.** 300 mots, 2 tableaux & fig.)

1927 624 .8 (.44)
nie civil, n° 2326, 12 mars, p. 272.
Le pont tournant dit « des écluses » dans le port vial de Strasbourg. (1 300 mots & fig.)

1927 624 .51 (.73)
nie civil, n° 2327, 19 mars, p. 281.
CAUFOURIER (P.). — **Le pont suspendu de Philaphie (Etats-Unis).** (4 600 mots, 1 tableau & fig.)

1927 721 .9
nie civil, n° 2327, 19 mars, p. 294.
Hourdis en béton armé, sans nervures ni chapiteaux colonnes. (600 mots & fig.)

1927 624 .2 (01
nie civil, n° 2327, 19 mars, p. 297.
MESNAGER. — **Résistance d'une poutre rectangure chargée en un point.** Angle sous la charge quand devient infiniment longue. Conséquences pour les ques. (700 mots.)

1927 621 .33 (.460) & 625 .4 (.460)
nie civil, n° 2328, 26 mars, p. 311.
RIBERA (J. E.). — **Les extensions du chemin de métropolitain « Alphonse XIII », à Madrid.** (1 500 ts & fig.)

1927 621 .333
nie civil, n° 2328, 26 mars, p. 313.
NEVEUX (V.). — **Les nouveaux accumulateurs de ction.** (3 200 mots & fig.)

1927 624 .8 (.73)
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Le pont basculant de la Flushing River, à New-York. 00 mots & fig.)

1927 656 .256.3 (.44)
Génie civil, n° 2329, 2 avril, p. 340.
NETTER (J.). — **Nouveaux appareils de bloc automatique pour voies ferrées.** (1 800 mots & fig.)

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BORDIER (H.). — **Le pont en béton armé d'Hydra, à Alger.** (800 mots & fig.)

1927 62. (01 & 669 .1
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DEJEAN (P.). — **Ecrouissage par traction.** Ecrouissage par compression. (700 mots & 1 tableau.)

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PARODI (H.). — **Le problème de l'électrification des chemins de fer français.** (5 200 mots, tabeaux & fig.)

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1927 621 .134.3
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SPIESS (E.). — **De l'emploi des hautes pressions pour les locomotives à vapeur à pistons.** (4 700 mots, 3 tableaux & fig.)

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Moulage d'un barreau de grille de locomotive. (600 mots & fig.)

1927 625 .144.4
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Machine repliable à percer les rails. (1 100 mots et figures.)

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SPIESS (E.). — **Essai de classification des locomotives par leurs caractéristiques propres.** (3 000 mots, 2 tableaux & fig.)

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A propos de la Super-Pacific Express du Chemin de fer du Nord. (1 600 mots, 1 tableau & fig.)

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PÉRIDIER. — **Unification des moteurs de traction.** (8 700 mots & tableaux.)

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BORDAS (F.). — La **réforme syndicale** en Italie. (4 300 mots.)

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ROUSSEL (A.). — Capacité de circulation des **chaussées et des voies ferrées.** (5 100 mots, 3 tableaux & fig.)

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PODOSKI (R. de). — Puissance des **moteurs de traction.** (10 000 mots, 3 tableaux & fig.)

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OUDOTTE. — **Pont supérieur en béton armé** sur la ligne de Culoz à Modane en gare de Modane-Fourneaux. (2 300 mots, 3 tableaux & fig.)

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Passage des wagons de la **voie normale à la voie russe.** (2 400 mots & fig.)

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HANOCQ (Ch.). — **Etude expérimentale des pali de transmission** effectuée au laboratoire de construct des machines de l'Université de Liège. (4 000 mo 1 tableau & fig.)

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SMITH (C.-A.). — Substantial economies obtained by **use of treated timber.** (900 words, tables & fig.)

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RUSSELL (G.-M.). — **Elastic deflection of t**
plates uniformly loaded. (1 600 words, 2 tables & f

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GOLTRA (W.-F.). — **Railroad tie specification**
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HAYDEN (A.-G.). — **Arch design** cheaper than
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New regulator for **superheater locomotives.** (300 words & fig.)

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1927 656 .222 (.73)
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FERTIG (H.-R.). — **System classification plan improves yard efficiency.** (5 600 words & fig.)

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First **Hudson type locomotive.** (1 600 words, 1 table & fig.)

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WYANT (L.). — **Simple interlocking** eliminates train stops in city streets. (1 500 words & fig.)

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Erie uses novel method eliminating **grade crossings.** (3 200 words & fig.)

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Railway Age, No. 9, Section one, February 26, p. 569.
Yard equipped with **car retarders** classifies 2 000 cars a day. (2 500 words, 1 table & fig.)

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Railway Age, No. 10, March 5, p. 639.
PEABODY (J. A.). — **Spring switches** used extensively on Chicago & North Western. (2 800 words & fig.)

1927 625 .13 ((.73)
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Pennsylvania rebuilds tunnel under adverse conditions. (2 600 words & fig.)

1927 656 .237 (.73)
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Illinois Central **budgets transportation expenses.** (2 400 words & fig.)

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RICE (N.-M.). — What the railways are doing to promote **forest conservation.** (2 600 words & fig.)

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Railway Age, No 10, March 5, p. 655.
First hundred years of the Baltimore & Ohio. (2 400 words & fig.)

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Steel dining cars for the D. L. & W. (750 words & fig.)

1927 621 .33 (.485)
Railway Age, No. 10, March 5, p. 665.
The Stockholm-Göteborg **electrification.** (1 600 words & fig.)

1927 621 .139 (.73), 625 .18 (.73) & 625 .27 (.73)
Railway Age, No. 15, March 12, p. 879.
Chesapeake & Ohio reorganizes **purchasing and stores** work. (1 400 words, 3 tables & fig.)

1927 621 .87 (.73) & 656 .212.6 (.73)
Railway Age, No. 15, March 12, p. 885.
B. & M. erects large **coal handling facilities at Boston.** (3 300 words & fig.)

1927 656 .223.2 (.73)
Railway Age, No. 15, March 12, p. 890.
The Chicago Great Western keeps its cars moving. (2 700 words, 2 tables & fig.)

1927 621 .132.5 (.73)
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The D. & H. receives a second **high pressure locomotive.** (2 200 words, 2 tables & fig.)

1927 621 .132.3 (.71) & 621 .132.5 (.71)
Railway Age, No. 16, March 19, p. 928.
Canadian Pacific's new locomotives give improved performance. (1 900 words, 1 table & fig.)

1927 621 .336 (.73)
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BELLINGER (F.-W.). — Maintaining an **overhead contact system.** (3 800 words, 2 tables & fig.)

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C. & O. **profits** from simpler stocks and better planning. (3 200 words, tables & fig.)

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ANDERSON (B. T.). — **C. & O. signals three-track line** for either direction operation. (2 200 words & fig.)

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Locomotive performance and its influence on modern practice. (2 000 words & fig.)

1927 621 .114
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Ranging curves from offsets. (800 words & fig.)

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Moutain type express locomotives, Northern of Spain Railway. (3 300 words, 3 tables & fig.)

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1927 621 .132.8 (.66) & 625 .616 (.66)

Revue générale des ch. de fer, avril, p. 387.

Locomotives Garratt 2—6—2 + 2—6—2 des Chemins de fer de Sierra Leone. (650 mots & 1 tableau.)

1927 625 .23

Revue générale des ch. de fer, avril, p. 391.

Serrure de sûreté, système « Kaye », pour portières de voitures de chemins de fer. (800 mots & fig.)

Revue universelle des transports. (Paris.)

1927 625 .11

Revue univ. des transp., n°s 73-74, 10-25 mars, p. 137.

BOUVET (M.). — Le **raccordement des déclivités** dans les voies ferrées. (1 000 mots & fig.)

1927 625 .232 (.4

Revue univ. des transp., n°s 73-74, 10-25 mars, p. 142

PAHIN (L. A. H.). — Les nouvelles **voitures-salons-restaurants Pullman** de la Compagnie Internationale des Wagons-Lits. (2 000 mots & fig.)

1927 621 .33 (.73)
Revue univ. des transp., nos 75-76, 10-25 avril, p. 162.
Développement en Amérique de la traction électrique durant l'année 1926. (1 700 mots).

In English.

Electric Railway Journal. (New York.)

1927 625 .174 (.73)
Electric Railway Journal, No. 13, March 26, p. 567.
STEWARD (H. M.). — **Snow-fighting methods** revolutionized. (1 200 words & fig.)

1927 621 .335 (.73) & 621 .338 (.73)
Electric Railway Journal, No. 13, March 26, p. 571.
Articulated cars in high-speed interurban service. (2 300 words, 2 tables & fig.)

1927 621 .335 (.73) & 621 .338 (.73)
Electric Railway Journal, No. 14, April 2, p. 602.
Joliet develops **worm-drive trucks** to reduce unsprung weight. (1 600 words & fig.)

1927 621 .338 (.73)
Electric Railway Journal, No. 15, April 9, p. 655.
Cleveland **aluminium car** proving successful. (1 300 words & fig.)

Engineer. (London.)

1927 621 .89 (01
Engineer, No. 3717, April 8, p. 376.
Institution of Mechanical Engineers. (4 700 words.)

1927 621 .132.6 (.42)
Engineer, No. 3717, April 8, p. 381.
A new **light steam locomotive.** (1 300 words & fig.)

1927 621 .1 (01
Engineer, No. 3718, April 15, p. 402.
DEMOULIN (M.). — The modern **steam engine and internal combustion motors.** (3 300 words & fig.)

1927 621 .132.8
Engineer, No. 3718, April 15, p. 410.
KITSON CLARK (E.). — **Internal combustion locomotives.** (3 200 words & fig.)

1927 621 .33 (.42) & 625 .4 (.42)
Engineer, No. 3720, April 29, p. 458.
The railway and urban improvements at Piccadilly Circus. (2 600 words & fig.)

1927 625 .254 (.54)
Engineer, No. 3720, April 29, p. 462.
The vacuum brake in India. (1 900 words.)

1927 62. (01 & 669
Engineer, No. 3720, April 29, p. 474.
GOUGH (H. J.). — Some modern views on the **fatigue of metals.** (4 900 words & fig.)

1927 62. (01
The Metall., suppl. to the Eng., No. 3720, Ap., 29, p. 54.
HANSON (D.). — Some observations on the **creep of metals.** (2300 words & 1 table.)

1927 621 .39
The Metall., suppl. to the Eng., No 3720, Ap. 29, p. 58.
Welding of iron and steel. (1 400 words.)

1927 62. (01 & 669
The Metall., suppl. to the Eng., No. 3720, Ap. 29, p. 61.
Tensile tests on flat test pieces. (1 700 words.)

1927 62. (01
Engineer, No. 3721, May 6, p. 487.
Institution of Mechanical Engineers. The **failure of some steel wires under repeated torsional stresses** at various mean stresses determined from experiments on helical springs. (3 000 words & fig.)

Engineering. (London.)

1927 52 .69
Engineering, No. 3188, February 18, p. 185.
LÜSCHER (H.). — Photographic **mapping methods.** (2 400 words & fig.)

1927 62. (01
Engineering, No. 3188, February 18, p. 209.
Investigations on **riveted joints.** (3 400 words, 2 tables & fig.)

1927 621 .134.5 (.43)
Engineering, No. 3195, April 8, p. 418.
Constant-lubrication valve for superheated steam locomotive cylinders. (700 words & fig.)

1927 621 .94
Engineering, No. 3195, April 8, p. 419.
Railway-wheel lathe with electrical control. (400 words & fig.)

1927 621 .89 (01
Engineering, No. 3195, April 8, p. 425.
The **Institution of Mechanical Engineers.** (4 200 words & 1 table.)

1927 621 .89 (01
Engineering, No. 3195, April 8, p. 435.
MARSHALL (A. G.). — **Lubricating oils;** Laboratory tests in relation to practical results. (5 300 words, 15 tables & fig.)

1927 621 .132.8
Engineering, No. 3196, April 15, p. 451.
KITSON CLARK (E.). — **The Kitson-still internal-combustion locomotive.** (2 500 words & fig.)

1927 624 .52 (01
Engineering, No. 3198, April 29, p. 506.
The theory of the **stiffened suspension bridge.** (3 500 words, 1 table & fig.)

1927 721 .9 (.42)
Engineering, No. 3198, April 29, p. 527.
Hodgkinson system of reinforced concrete beams. (600 words & fig.)

1927 621 .116
Engineering, No. 3199, May 6, p. 552.
Boiler failures. (2 200 words.)

1927 62. (01
Engineering, No. 3199, May 6, p. 562.
LEA (F. C.) & HEYWOOD (F.). — **Failure of helical springs.** (3 700 words & fig.)

Engineering News-Record. (New York.)

1927 624 .63 (.73)
Engineering News-Record, No. 13, March 31, p. 514.
WHEELER (W. H.). — **Long concrete-arch road bridge** over Minnesota River. (4 300 words, 2 tables & fig.)

1927 624 .7 (.73)
Engineering News-Record, No. 14, April 7, p. 564.
Concrete-cased steel viaduct with special expansion joints. (1 000 words & fig.)

1927 624 .2 (01 (.73) & 693 (.73)
Engineering News-Record, No. 14, April 7, p. 574.
SHANK (J. R.). — **Tests of corroded steel beams** restored with Gunite. (1 500 words, 1 table & fig.)

1927 624 .1 (.73)
Engineering News-Record, No. 16, April 21, p. 638.
CADY (R. W.). — **Buffalo-Fort Erie bridge piers** built in swift current. (2 400 words & fig.)

1927 624 .7 (.73)
Engineering News-Record, No. 16, April 21, p. 650.
HOUGH (J. F.). — Old iron viaduct converted to **reinforced-concrete structure.** (2 600 words & fig.)

1927 625 .143.4 (.73)
Engineering News-Record, No. 16, April 21, p. 654.
C., M. & St. P. Ry. adopts **fish-plate splice for 130-lb. rails.** (250 words & fig.)

1927 691. (01 (.73)
Engineering News-Record, No. 16, April 21, p. 655.
BENHAM (W. L.). — **Concrete mix designing** on an Oklahoma dam. (1 700 words & fig.)

1927 62. (01 & 721 .3
Engineering News-Record, No. 17, April 28, p. 682.
Column strength under eccentric and shear loading. (1 400 words & fig.)

1927 624 .52 (.73)
Engineering News-Record, No. 17, April 28, p. 686.
GOODRICH (C. F.). — Counterweighted cables raise 433-ft. spans to **high-level cantilever bridge.** (2 700 words & fig.)

1927 624 .1 (.73)
Engineering News-Record, No. 17, April 28, p. 695.
Steel sheetpiling used in repair of bridge approaches. (700 words & fig.)

1927 624 .31 (.73)
Engineering News-Record, No. 17, April 28, p. 699.
Logging timber bridge in Northwest is 204 1/2 ft. high. (400 words & fig.)

Great Western Railway Magazine. (London.)

1927 385 .517 (.42)
Great Western Ry. Magazine, May, p. 177.
WHITE (A. J. L.). — The Swindon works **welfare institutions.** (3 200 words & fig.)

Journal of the Institute of Transport. (London.)

1927 656 .1 (.42)
Journal of the Institute of Transport, April, p. 268.
Le M. GOSSELIN (C.). — A survey of **road transport.** (18 700 words & 4 tables.)

1927 625 .244 (.42)
Journal of the Institute of Transport, April, p. 290.
PIQUÉ (J.). — The **transport of fresh fish.** (7 000 words, 3 tables & fig.)

1927 656 .1 (.42)
Journal of the Institute of Transport, April, p. 306.
BRUNNER (C. T.). — The taxation of **mechanical road transport.** (9 300 words.)

Machinery. (New York.)

1927 621 .94 (.73)
Machinery, April, p. 598.
Milling practice in a railroad shop. Methods used by one of the New York Central shops in keeping locomotives fit for service. (1 500 words & fig.)

Mechanical Engineering. (New York.)

1927 621 .94 & 669 .1
Mechanical Engineering, April, p. 339.
FRENCH (H. J.) & DIGGES (T. G.). — **Rough turning** with particular reference to the steel cut. (10 000 words, 6 tables & fig.)

1927 621 .134.1
Mechanical Engineering, April, p. 369.
Heat-exchange losses in **locomotive cylinders.** (1 300 words & fig.)

1927 621 .392 (.73)
Mechanical Engineering, May, p. 405.
ROCKEFELLER (H. E.). — **Oxyacetylene-welded construction** of a large high-pressure storage tank. (4 700 words & fig.)

1927 51. (08
Mechanical Engineering, May, p. 414.
GITHENS (T. F.). — Tolerance and allowance charts for **metal fits.** (350 words & fig.)

1927 621 .134.1 (01

Mechanical Engineering, May, p. 455.

The influence of clearance on the specific steam consumption of steam engines and especially of locomotives. (2 000 words, 1 table & fig.)

Modern Transport. (London.)

1927 656 .253 (.73)

Modern Transport, No. 425, May 7, p. 5.

Train control in the United States. (2 300 words & fig.)

Proceedings, American Society of Civil Engineers. (New York.)

1927 355 (.44) & 621 .133.7 (.44)

Proceed. American Soc. Civil Eng., April, p. 540.

LABACH (P. M.). — Water supply for army railways in France. (11 000 words, 3 tables & fig.)

1927 624 .5 (01

Proceed. American Soc. Civil Eng., April, p. 594.

Quantities of materials and costs per square foot of floor for highway and electric railway long-span suspension bridges. (7 500 words, 2 tables & fig.)

Proceedings, Institution of Mechanical Engineers. (London.)

1926 62. (01

Proceed. Institut. of Mechan. Eng., November, p. 897.

COKER (E. G.). — Elasticity and plasticity. (12 800 words & fig.)

1926 621 .1 (01

Proceed. Institut. of Mechan. Eng., November, p. 943.

REYNOLDS (W. H.). — Considerations influencing the design of steam generating plants. (4 800 words & fig.)

1926 621 .13 & 621 .335

Proceed. Institut. of Mechan. Eng., November, p. 1001.

STONE (T. A. F.). — Electric locomotives: a method of classifying, analysing and comparing their characteristics. (12 300 words, 10 tables & fig.)

Proceedings, Institution of Railway Signal Engineers. (Manchester.)

1926-27 656 .25 (01 (.42 + .73)

Proceed. Institut. Ry. Signal Eng., Sept. to Jan., p. 117.

PARSONS (J.). — A comparative survey of American and British signalling. (9 500 words & fig.)

1926-27 656 .254

Proceed. Institut. Ry. Signal Eng., Sept. to Jan., p. 148.

HARRISON (H. H.). — The fundamentals of automatic telephone switching. (9 900 words & fig.)

1926-1927 621 .39 & 656 .25

Proceed. Institut. Ry. Signal Eng., Sept. to Jan., p. 176.

TWEEDIE (M. G.). — Electrical power for railway signalling and communication. (16 000 words, 2 tables & fig.)

1926-27 656 .25 (.43)

Proceed. Institut. Ry. Signal Eng., Sept. to Jan., p. 222.

LASCELLES (T. S.). — Railway signalling in Germany. (16 000 words & fig.)

Railway Age. (New York.)

1927 621 .131.3 (.73) & 621 .4 (.73)

Railway Age, No. 17, March, 26, Section one, p. 975.

FRY (L. H.). — Locomotive 60 000 tests results. (2 600 words, 2 tables & fig.)

1927 385 .15 (.73) & 385 .21 (.73)

Railway Age, No. 17, March 26, Section one, p. 979.

DUNN (S. O.). — Transportation economies and current problems. (5 200 words.)

1927 621 .132.8 (.73)

Railway Age, No. 17, March 26, Section one, p. 983.

Frisco gets mechanical drive gasoline rail cars. (1 500 words & fig.)

1927 385. (09.1 (.73)

Railway Age, No. 17, March 26, Section one, p. 986.

Santa Fe handles rush oil field traffic without delay. (4 300 words, 1 table & fig.)

1927 621 .138.2 (.73) & 656 .212.6 (.73)

Railway Age, No. 17, March 26, Section one, p. 998.

Large coaling station embodies new features. (800 words & fig.)

1927 656 .1 (.73) & 656 .2 (.73)

Railway Age, No. 17, March 26, Section two, p. 1021.

Pacific Electric co-ordinates rail and bus service. (2 200 words & fig.)

1927 656 .1 (.73) & 656 .2 (.73)

Railway Age, No. 17, March 26, Section two, p. 1034.

FRITCH (H. F.). — B. & M. finds merit in co-ordinated highway service. (2 800 words & fig.)

1927 625 .13 (.73)

Railway Age, No. 18, April 2, p. 1050.

Erection of Steubenville bridge introduces novel problems. (3 700 words & fig.)

1927 656 .224 (.73)

Railway Age, No. 18, April 2, p. 1055.

LYNE (J. G.). — Our improving passenger service. (3 400 words & fig.)

1927 621 .132.8 (.4) & 621 .134.3 (.4)

Railway Age, No. 18, April 2, p. 1059.

Europe shows way to increased motive power efficiency. (2 500 words & fig.)

1927 625 .1 (.725)
Railway Age, No. 19, April 9, p. 1108.
CHAMBERS (R.). — Southern Pacific of Mexico finishes main line to Guadalajara. (4 300 words & fig.)

1927 625 .245 (.73)
Railway Age, No. 19, April 9, p. 1119.
Steel box and automobile cars for the C. R. R. of N. J. (1 300 words, 1 table & fig.)

1927 621 .132.3 (.73)
Railway Age, No. 19, April 9, p. 1121.
The Baltimore & Ohio's « President » class locomotives. (1 000 words, 1 table & fig.)

1927 385 .524 (.73) & 656 .212.9 (.73)
Railway Age, No 19, April 9, p. 1135.
Merchandise handling speeded by tonnage bonus system. (2 700 words & fig.)

1927 625 .143.2
Railway Age, No. 20, April 16, p. 1188.
GENNET, Jr. (C. W.). — What can be done to improve the quality of steel rails? (3 800 words & fig.)

1927 621 .335 (.73)
Railway Age, No. 20, April 16, p. 1195.
Rail motor car service on B. & M. (1 900 words, 1 table & fig.)

1927 656 .24 (.73)
Railway Age, No. 20, April 16, p. 1202.
Santa Fe cuts freight claims. (3 800 words, 1 table & fig.)

1927 625 .245 (.73)
Railway Age, No. 20, April 16, p. 1208.
C. M. & St. P. automobile cars with 12-ft. side doors. (700 words & fig.)

1927 621 .132.3 (.73)
Railway Age, No. 21, Section one, April 23, p. 1239.
The Northern Pacific 4—8—4 type locomotives. (1 700 words, 1 table & fig.)

1927 621 .138.1 (.73)
Railway Age, No. 21, Section one, April 23, p. 1243.
Mechanical cinder plant serves several tracks. (1 000 words & fig.)

1927 621 .138.1 (.73) & 725 .33 (.73)
Railway Age, No. 21, Section one, April 23, p. 1245.
ELKAN (S. A.). — Central of Georgia builds new engine terminal. (1600 words & fig.)

1927 385. (09.1 (.52)
Railway Age, No. 21, Section one, April 23, p. 1254.
KINNOSUKE (A.). — South Manchuria Railway — A line of destiny. (3 600 words & fig.)

1927 625 .214 & 656 .221
Railway Age, No. 21, Section one, April 23, p. 1258.
BRUNNER (H. E.) & TAWRESEY (J. S.). — Journal friction in relation to train operation. (2 000 words & fig.)

1927 621 .33 (.71
Railway Age, No. 21, Section one, April 23, p. 1265.
HALL (W. D.). — Operation through the St. Clair tunnel. (1 900 words & fig.)

Railway Engineer. (London.)

1927 656 .253 (.44
Railway Engineer, May, p. 169.
SHERRINGTON (C. E. R.). — Repetition of signal positions in engine cabs, Northern of France Railway (2 200 words & fig.)

1927 621 .87 (.42) & 656 .212.6 (.42
Railway Engineer, May, p. 179.
Two large railway cranes. (1 800 words & fig.)

1927 621 .131.1 (0
Railway Engineer, May, p. 182.
Tractive effort of internal-combustion locomotives (1 200 words & fig.)

1927 624 .
Railway Engineer, May, p. 184.
An obsolete type of bridge girder. (2 000 words & fig.)

1927 621 .132.5 (.82
Railway Engineer, May, p. 188.
Three-cylinder 2—8—0 type freight locomotives for Argentina. (500 words & fig.)

1927 625 .245 (.494
Railway Engineer, May, p. 191.
Either side wagon tipping gear. (400 words & fig.)

1927 621 .9
Railway Engineer, May, p. 191.
Finishing metal surfaces in locomotive and rolling stock works. (1 000 words & fig.)

1927 625 .212. (01 (.42
Railway Engineer, May, p. 193.
Testing the electrial bonding of wheels. (1 300 words & fig.)

Railway Engineering & Maintenance. (Chicago.)

1927 625 .142.2 (.73) & 691 (.73)
Railway Engineering & Maintenance, April, p. 150.
BELCHER (R. S.). — Better care of treated ties (4 500 words, 1 table & fig.)

1927 624 .1 (.73) & 627 (.73)
Railway Engineering & Maintenance, April, p. 156.
Plenty of spring in this pier fender. (1 000 words & fig.)

1927 625 .1(.73)
Railway Engineering & Maintenance, April, p. 159.
BOWLER (R. W. E.). — Building a second reack in short time. (1 800 words & fig.)

1927 621 .133.7 (.73)
Railway Engineering & Maintenance, April, p. 161.
How to select **water supplies.** (1 900 words, 1 table & fig.)

1927 625 .144.4 (.73) & 625 .15 (.73)
Railway Engineering & Maintenance, April, p. 163.
HARTING (O. F.). — Are **foundations under crossings** worth while? (5 700 words & fig.)

1927 691 (.73)
Railway Engineering & Maintenance, April, p. 168.
Getting greater early **strength in concrete.** (1 000 words, 1 table & fig.)

1927 625 .144.4 (.73)
Railway Engineering & Maintenance, April, p. 175.
A rail laying machine which will also raise or shift track. (700 words & fig.)

Railway Gazette & Railway News. (London.)

1927 385 .586 (.42) & 656 .25 (.42)
Railway Gazette & News, No. 14, April 8, p. 473.
« Underground » **school of signalling** at South Kensington. (1 400 words & fig.)

1927 621 .335 (.42) & 621 .338 (.42)
Railway Gazette & News, No. 14, April 8, p. 474.
New **electric rolling-stock, L. M. S. R.** (600 words & fig.)

1927 656 .283 (.42)
Railway Gazette & News, No. 14, April 8, p. 481.
Railway accident report. — Naworth, London & North Eastern: August 30, 1926. (1 500 words & fig.)

1927 385. (0 (.42)
Railway Gazette & News, No. 15, April 15, p. 497.
Future of **British Railways.** (1 200 words.)

1927 621 .331 (.42)
Railway Gazette & News, No. 16, April 22, p. 524.
New plant at Neasden power station, Metropolitan Railway. (1 500 words & fig.)

1927 621 .9 (.42)
Railway Gazette & News, No. 16, April 15, p. 526.
A new **machine tool** for locomotive shops. (650 words & fig.)

1927 621 .132.7 (.73)
Railway Gazette & News, No. 16, April 15, p. 528.
Shunting locomotive practice in America. (550 words & fig.)

1927 625 .255 (.44)
Railway Gazette & News, No. 16, April 15, p. 530.
D. C. regenerative braking for heavy electric traction. (1 500 words & fig.)

1927 625 .213 (.54)
Railway Gazette & News, No. 16, April 15, p. 532.
Double-leaf spring for railway rolling stock. (100 words & fig.)

1927 656 .281 (.42)
Railway Gazette & News, No. 16, April 15, p. 539.
Railway accident report. Charing Cross, Southern: October 12, 1926. (1 700 words & fig.)

1927 621 .335 (.73)
Railway Gazette & News, No. 17, April 29, p. 558.
Electrification on the Great Northern Railway, U. S. A. (800 words & fig.)

1927 625 .112 (.6 + .8 + .94)
Railway Gazette & News, No. 17, April 29, p. 562.
Railway gauges in Australia, South America and Africa. (1 500 words & 3 tables.)

1927 621 .132.8 (.82) & 625 .175 (.82)
Railway Gazette & News, No. 18, May 6, p. 588.
Internal-combustion locomotive tractors and inspection cars. (1200 words & fig.)

Railway Magazine. (London.)

1927 656 .222.1 (.42)
Railway Magazine, May, p. 369.
ALLEN (C. J.). — **British locomotive practice and performance.** (5 400 words, 3 tables & fig.)

Railway Mechanical Engineer. (New York.)

1927 621 .132.3 (.73)
Railway Mechanical Engineer, March, p. 139.
Hudson type locomotive on N. Y. C. (1 700 words, 1 table & fig.)

1927 621 .134.3
Railway Mechanical Engineer, March, p. 142.
CAPROTTI (A.). — The **Caprotti poppet valve gear.** (3 000 words & fig.)

1927 621 .335 (.73)
Railway Mechanical Engineer, March, p. 146.
Gas-electric cars on the D. T. & I. (1 400 words & fig.)

1927 625 .235 (.73) & 691 (.73)
Railway Mechanical Engineer, March, p. 150.
EDGAR (W. S.). — The use of **wood lacquer finishes.** (3 000 words.)

1927 625 .245 (.73) & 621 .87 (.73)
Railway Mechanical Engineer, March, p. 153.
Automobile cars fitted with **traveling cranes.** (600 words & fig.)

1927 621 .9 & 669 .1
Railway Mechanical Engineer, March, p. 172.
LOUNSBERRY (F. B.). — **Tool steel failures** — their causes and cures. (2 400 words & fig.)

1927 621 .132.3 (.71) & 621 .132.5 (.71)
Railway Mechanical Engineer, April, p. 196.
Locomotive boilers with nickel steel shells. (2 200 words, 2 tables & fig.)

1927 621 .133.7 (01
Railway Mechanical Engineer, April, p. 200.
JONES (V. L.). — **Feedwater heaters on locomotives.** (3 000 words.)

1927 621 .135.4
Railway Mechanical Engineer, April, p. 202.
BLUNT (J. G.). — **Guiding into and around curves.** (1 800 words & fig.)

1927 621 .132.5 (.73)
Railway Mechanical Engineer, April, p. 207.
The « John B. Jervis » — **a high pressure locomotive.** (2 000 words, 2 tables & fig.)

1927 625 .235 (.73) & 691 (.73)
Railway Mechanical Engineer, April, p. 213.
Lacquer finishes as applied to passenger cars. (3 500 words.)

1927 625 .245 (.73)
Railway Mechanical Engineer, April, p. 217.
C. R. R. of N. J. buys **steel box and automobile cars.** (1 600 words, 1 table & fig.)

Railway Signaling. (Chicago.)

1927 656 .256.3 (.73)
Railway Signaling, April, p. 130.
SMITH (B. L.). — Chicago South Shore & South Bend changes **signal equipment.** (1 700 words & fig.)

1927 656 .257 (.73)
Railway Signaling, April, p. 133.
ANDERSON (B. T.). — C. & O. completes **three-track, color-light, either-direction signaling.** (3 200 words & fig.)

1927 656 .254 (.73)
Railway Signaling, April, p. 148.
WYANT (L.). — Three roads eliminate **train stops in streets** of Cedar Rapids, Iowa. (1 600 words & fig.)

In Italian.

Rivista tecnica delle ferrovie italiane. (Roma.)

1927 621 .331 (.45)
Rivista tecnica delle ferrovie ital., 15 marzo, p. 97.
MIRONE (L.). — **Impianti idroelettrici dell'Alto Reno** e delle Limentre. Diga sul Reno presso Molino del Pallone. (2 100 parole & fig.)

1927 624 .61 (.45)
Rivista tecnica delle ferrovie ital., 15 aprile, p. 141.
La ricostruzione del ponte di Salcano. Ricostruzione della grande arcata della luce di m. 85 del ponte sull' Isonzo presso Salcano sulla linea Trieste C. M. Piedicolle. (900 parole & fig.)

1927 625 .244 (.45) & 625 .245 (.45)
Rivista tecnica delle ferrovie ital., 15 aprile, p. 145.
GIOVANARDI. — Veicoli di nuova costruzione delle Ferrovie dello Stato. **I nuovi carri.** (2 400 parole & fig.)

1927 625 .143.2
Rivista tecnica delle ferrovie ital., 15 aprile, p. 152.
MEUCCI (G.). — Contributo agli studi sulla **durata in opera delle rotaie di acciaio.** (1 600 parole.)

1927 625 .215
Rivista tecnica delle ferrovie ital., 15 aprile, p. 161.
GIOVENE (N.). — L'applicazione della **teoria degli svii.** (2 500 parole, 1 quadro & fig.)

In Spanish.

Boletin de Obras Públicas de la República Argentina. (Buenos Aires.)

1927 656 .23
Boletin de Obras Públicas, marzo, p. 219.
REBUELTO (E.). — **Las rebajas de tarifas en relación con los aumentos de tráfico.** (2 300 palabras.)

Ingenieria y Construcción. (Madrid.)

1927 621 .132.5 (.4)
Ingenieria y Construcción, febrero, p. 53.
AZA (P.) & COSTILLA (B.). — **Las locomotoras « Montana » en Europa.** (2 800 palabras & 2 tablas.)

1927 669
Ingenieria y Construcción, febrero, p. 65.
GARCIA (M. F.). — **Análisis de un metal antifricción.** (2 200 palabras.)

1927 621 .39
Ingenieria y Construcción, febrero, p. 67.
CANDY (A. M.) & FISH (G. D.). — **Estructuras metálicas soldadas.** (4 000 palabras & fig.)

1927 62. (01
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MAGNÉE (P.). — **Description sommaire de la locomotive type « Mikado » pour voie de 0m763 du Chemin de fer du Congo construite par les Ateliers de Tubize.** (600 mots & fig.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1927 351 (.43 + .44) & 385 .3 (.43 + .44)
Archiv für Eisenbahnwesen, Heft 3, Mai-Juni, S. 561.
OTTMANN (K.). — **Das öffentliche Eisenbahnrecht Frankreichs.** Eine rechtsvergleichende Darstellung. (18 000 Wörter u. Abb.)

1927 385 .5 (.73)
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RÖHLING (K.). — Das **Eisenbahn-Arbeitsgesetz der** Vereinigten Staaten von Amerika. (4 600 Wörter.)

1927 385. (09.1 (.81)
Archiv für Eisenbahnwesen, Heft 3, Mai-Juni, S. 625.
BLOCH (E.). — **Verkehrsprobleme** des Staats São Paulo. (17 000 Wörter, Tabellen u. Abb.)

1927 656 .222.1 (.43)
Archiv für Eisenbahnwesen, Heft 3, Mai-Juni, S. 743.
JEZEWSKI (S. v.). — Die **Fahrgeschwindigkeit der deutschen Schnellzüge 1900-1925.** (2 300 Wörter u. 3 Tabellen.)

1927 313 .385 (.494)
Archiv für Eisenbahnwesen, Heft 3, Mai-Juni, S. 787.
Die **Eisenbahnen der Schweiz** in den Jahren 1923 und 1924. (6 Tabellen.)

1927 385 .113 (.494)
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Die **Schweizerischen Bundesbahnen** in den Jahren 1924 und 1925. (Tabellen.)

1927 313 .385 (.438)
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1927 385. (09.1 (.51)
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Die **Eisenbahnen Chinas** während des Bürgerskriegs. (2 900 Wörter u. Tabellen.)

Elektrische Bahnen. (Charlottenburg.)

1927 621 .335 (.43)
Elektrische Bahnen, 15. Januar, S. 1.
WECHMANN (W.) — Der **elektrische Zugbetrieb** der Deutschen Reichsbahn-Gesellschaft im Jahre 1926. (1 500 Wörter u. 5 Tabellen.)

1927 621 .31 (.433)
Elektrische Bahnen, 15. Januar, S. 6.
NADERER (Gg.). — Die **Schaltung von Fahrleitungsnetzen** für Wechselstrom-Fernbahnen im Reichsbahndirektionsbezirk München. (11 000 Wörter u. Abb.)

1927 621 .335 (.43)
Elektrische Bahnen, 15. Februar, S. 41.
KLEINOW (W.). — **Elektrische Schnellzuglokomotive** mit Einzelachsantrieb. (5 200 Wörter u. Abb.)

1927 621 .335 (.494)
Elektrische Bahnen, 15. Februar, S. 53.
MEYFARTH (G. L.). — Die neuen **Lötschberg-Lokomotiven** Type 1AAA-AAA1. (2 900 Wörter u. Abb.)

1927 385 .113 (.494) & 621 .33 (.494)
Elektrische Bahnen, 15. Februar, S. 65.
USBECK (W.). — **Wirtschaftlichkeit der elektrischen Zugförderung in der Schweiz.** (2 200 Wörter, 4 Tabellen u. Abb.)

1927 621 .335 (.43)
Elektrische Bahnen, 15. März, S. 71.
WICHERT (A.). **Die 1 Do 1 = Lokomotiven** der Deutschen Reichsbahn-Gesellschaft. (8 500 Wörter u. Abb.)

1927 621 .39 & 625 .234
Elektrische Bahnen, 15. März, S. 92.
RAUCH (A.). — Internationale Vereinbarungen über **elektrischen Zugheizung.** (8 400 Wörter u. Abb.)

1927 621 .335 (.43)
Elektrische Bahnen, 15. April, S. 105.
ARNS (H.). — Die **Wechselstrom-Lokomotive** der Deutschen Reichsbahn-Gesellschaft auf dem Wege zur Vereinheitlichung. (4 900 Wörter u. Abb.)

1927 621 .33 (.460)
Elektrische Bahnen, 15. April, S. 113.
REINHART (W.). — Einführung des **elektrischen Zugbetriebs** auf Hauptbahnen in Spanien. (5 500 Wörter u. Abb.)

1927 621 .33 (.433)
Elektrische Bahnen, 15. April, S. 123.
MÜHL (H.). — Das zweite Betriebsjahr im **elektrisierten Streckengebiet Bayerns** der Deutschen Reichsbahn-Gesellschaft. (3 100 Wörter u. Abb.)

1927 621 .332 (.433)
Elektrische Bahnen, 15. Mai, S. 137.
SCHULTHEISS (L.). — **Die Leitungsanlagen der elektrischen Vollbahnen** in Bayern. B. Die Fahrleitungen. (4 300 Wörter u. Abb.)

1927 621 .32 & 656 .215
Elektrische Bahnen, 15. Mai, S. 154.
PONTANI. — **Beleuchtung von Bahnhöfen** an elektrischen Strecken. (1 500 Wörter, 1 Tabelle u. Abb.)

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1927 621 .139 (.43)
Glasers Annalen, Heft 3, 1. Februar, S. 39.
ILTGEN. — **Normung, Austauschbau und Massenfertigung bei den vorhandenen Lokomotiven der Deutschen Reichsbahn.** (4 600 Wörter u. Abb.)

1927 625 .245 (.43)
Glasers Annalen, Heft 7, 1. April, S. 111.
MÜLLER (K. A.). — **Ein neuer Selbstentlader für schüttbares Massengut.** (450 Wörter u. Abb.)

1927 621 .132.7
Glasers Annalen, Heft 9, 1. Mai, S. 133.
CAESAR. — **Eine neue Verschiebemaschine** (D.R.P. 440288). (2 500 Wörter & Abb.)

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Electric Railway Journal. (New York.)

1927 621 .331 (.71)
Electric Railway Journal, No. 18, April 30, p. 767.
First Canadian automatic rectifier substation installed by Montreal Tramways. (2 600 words, 1 table & fig.)

1927 625 .62 (.45)
Electric Railway Journal, No. 22, May, 28, p. 945.
BLAKE (H. W.). — **Transportation** in the Eternal City. (3 800 words, 2 tables & fig.)

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1927 669 .1
The Metall., p. 75, Suppl. to the Eng., No. 3724, May 27.
The quality of steel with reference to steel making processes. (2 200 words & fig.)

1927 656 .211.7 (.489)
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A large oil engine-propelled train ferry. (800 words & fig.)

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HADFIELD (Sir Robert). — **Manganese and ferro-manganese.** (5 300 words, 1 table & fig.)

1927 62. (01 & 669 .1
Engineering, No. 3 200, May 13, p. 590.
ATKINS (E. A.). — **The drawing of steel wire and its relation to qualities of steel.** (6 800 words, 1 table & fig.)

1927 621 .335. (01 & 621 .43 (01
Engineering, No. 3201, May 20, p. 608.
The development of the Diesel-electric locomotive. (3 400 words & fig.)

1927 669 .1
Engineering, No. 3202, May 27, p. 653.
HATFIELD (W. H.). — **Heat resisting steels.** (4 300 words, 9 tables & fig.)

1927 621 .112. (01
Engineering, No. 3203, June 3, p. 668.
ROLES (T.). — **Recent developments in power plant design and their effects on the economy of generation.** (2 200 words.)

1927 669 .1
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HAUGHTON (J. L.). — **The constitution of alloys of iron and phosphorus.** (3 000 words, 2 tables & fig.)

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1927 721 .9 (.73) & 725 .34 (.73)
Engineering News-Record, No. 18, May 5, p. 730.
HAMMOND (L. C.). — **Layout of concreting plants for three warehouses.** (2 800 words & fig.)

1927 624 .32 (.73)
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KIRKHAM (J. E.). — **Five Missouri River highway bridges** in South Dakota. (2 600 words & fig.)

1927 624 .52 (.73)
Engineering News-Record, No. 19, May 12, p. 777.
STEINMAN (D. B.). — **Designing the Carquinez cantilever bridge.** (4 400 words & fig.)

1927 624 .62 (.71 + .73)
Engineering News-Record, No. 20, May 19, p. 802.
Erecting long bridge spans over Niagara River. (2 900 words & fig.)

1927 656 .211.7 (.71 + .73)
Engineering News-Record, No. 20, May 19, p. 807.
Car-ferry landing at Milwaukee; Grand Trunk Ry. (1 600 words & fig.)

1927 62. (01 (.73) & 691 (.73)
Engineering News-Record, No. 20, May 19, p. 814.
NELSON (D. O.) & NICHOL (F. E.). — **Prediction of 28-day strength of concrete.** (1 700 words, 2 tables & fig.)

1927 625 .13 (.73)
Engineering News-Record, No. 21, May 26, p. 850.
JERMAN (D. T.). — **Moving the 440-ft. truss spans of Sixth St. bridge, Pittsburgh.** (900 words & fig.)

Great Western Railway Magazine. (London.)

1927 **385. (06.4 (.42)**

(Great Western Railway Magazine, June, p. 235.

Great Western Railway models in exhibition. (1 500 words & fig.)

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1927 **621 .131**

Loc. Ry. Carriage & Wagon Review, May 14, p. 159.

Factors in the design of steam locomotives. (2 000 words.)

1927 **621 .134.3 (.42)**

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BREWER (F. W.). — **Modern locomotive superheating on the Great Western Railway.** (2 200 words.)

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1927 **621 .132.8 & 621 .43**

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ARTHUR (W.). — **Diesel traction for railroads.** (4 200 words & fig.)

1927 **621 .112. (01**

Mechanical Engineering, June, p. 600.

MARKS (L. S.). — **A steam-pressure transformer.** (2 200 words, 2 tables & fig.)

1927 **621 .18**

Mechanical Engineering, June, p. 603.

ALDEN (V. E.). — **Present tendencies of steam-station design.** (8 300 words, 1 table & fig.)

1927 **62. (01 & 669 .1**

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FRAME (W. M.). — **Stresses occurring in the walls of an elliptical tank subjected to low internal pressures.** (3 600 words, 1 table & fig.)

1927 **625 .214. (01**

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KARELITZ (G. B.). — **The lubrication of waste-packed bearings.** (4 300 words, 1 table & fig.)

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1927 **385. (09.1 (.42)**

Modern Transport, No. 426, May 14, Birmingh. Congr. Suppl., p. 4.

Birmingham as a railway centre. Efficient passenger services by two competitive Companies. (2 800 words & fig.)

1927 **625 .144.4 (.73)**

Modern Transport, No. 428, May, 28, p. 7.

Reduction of permanent way maintenance costs. **Concrete track beds in United States.** (1 100 words & fig.)

Proceedings, American Society of Civil Engineers. (New York.)

1927 **625 .13 (.73)**

Proceed. American Soc. Civil Engineers, May, p. 681.

GAUSMANN (R. W.). — **The Shandaken tunnel.** (10 000 words, 7 tables & fig.)

1927 **624 .51 (.81)**

Proceed. American Soc. Civil Engineers, May. p. 707.

STEINMAN (D. B.) & GROVE (W. G.). — **The eye-bar cable suspension bridge at Florianopolis, Brazil** (22 000 words, 12 tables & fig.)

1927 **656 .1 (.73) & 656 .2 (.73)**

Proceed. American Soc. Civil Engineers, May, p. 793.

BUDD (R.). — **The relation of highway transportation to the Railway.** (10 500 words, 1 table & fig.)

1927 **621 .14 (.71 + .73) & 656 .1 (.71 + .73)**

Proceed. American Soc. Civil Engineers, May, p. 813.

BUDD (B. I.). — **Urban and interurban buses.** (3 500 words.)

1927 **625 .3 (.73)**

Proceed. American Soc. Civil Engineers, May, p. 831.

RYAN (W. J.). — **Logging railroads.** (4 000 words & fig.)

1927 **624 .6 (01 & 721 .4 (01**

Proceed. American Soc. Civil Engineers, May, p. 924.

JANNI (A. C.). — **The design of a multiple-arch system and permissible simplifications.** (9 500 words, 8 tables & fig.)

Proceedings, Institution of Civil Engineers. (London.)

1925-26 **625 .3 (09.1 (.54)**

Proceed., Institut. of Civil Eng., Vol. 222, part 2, p. 1.

BAYLEY (V.). — **The Khyber Railway.** (7 300 words, 2 tables & fig.)

1925-26 **625 .1 (.54) & 625 .3 (.54)**

Proceed., Institut. of Civil Eng., Vol. 222, part, 2, p. 23.

HEARN (Col. G. R.). — **The survey and construction of the Khyber Railway.** (21 600 words, tables & fig.)

1925-26 **625 .1 (.943) & 625 .3 (.943)**

Proceed., Institut. of Civil Eng., Vol. 222, part 2, p. 121.

TUFFLEY (A. E.). — **The construction of the mountain section of the Many Peaks to Northern Burnett Railway, Queensland.** (10 800 words, tables & fig.)

1925-26 **621 .392**

Proceed., Institut. of Civil Eng., Vol. 222, part 2, p. 158.

REESON (J. N.). — **The influence of electric welding in the design and fabrication of plant and structures.** (19 000 words, tables & fig.)

Proceedings, Institution of Mechanical Engineers. (London.)

1927 621 .112. (01

Proceed. Institut. of Mechan. Engineers, January, p. 53.

MELLANBY (A. L.) & KERR (W.). — The use and economy of high-pressure steam-plants. (14 200 words & fig.)

1927 621 .112. (01

Proceed. Institut. of Mechan. Engineers, January, p. 99.

GUY (H. L.). — The economic value of increased steam pressure. (46 000 words, 9 tables & fig.)

Railway Age. (New York.)

1927 625 .111 (.73)

Railway Age, No. 22, April 30, p. 1315.

N. Y. C. eliminates **grade crossings** under heavy traffic. (3 200 words & fig.)

1927 656 .284 (.73)

Railway Age, No. 22, April 30, p. 1321.

Railways fighting **record flood.** (1 900 words & fig.)

1927 621 .335 (.73)

Railway Age, No. 22, April 30, p. 1333.

Rock Island adds to its power **rail car equipment.** (2 300 words & fig.)

1927 625 .232 (.725)

Railway Age, No. 22, April 30, p. 1343.

President Calles gets **new train.** (1 000 words & fig.)

1927 625 .162 (.73)

Railway Age, No. 23, May 7, p. 1385.

FORD (R. H.). — Lack of unified control complicates **highway crossing problems.** (4 600 words & fig.)

1927 656 .284 (.73)

Railway Age, No. 23, May 7, p. 1389.

Flood continues to inflict damage. (3 200 words & fig.)

1927 656 .212.6 (.73)

Railway Age, No. 23, May 7, p. 1398.

Monorail loader for box car. (500 words & fig.)

1927 621 .132.3 (.42)

Railway Age, No. 23, May 7, p. 1403.

Four-cylinder locomotive for express service in England. (800 words, 1 table & fig.)

1927 721 .1 (.73)

Railway Age, No. 24, May 14, p. 1432.

SKINNER (F. W.). — **Dig 210-ft. foundation** wells for Cleveland terminal. (1 600 words & fig.)

1927 656 .284 (.73)

Railway Age, No. 24, May 14, p. 1435.

Railways in lower Mississippi Valley now bear brunt of flood. (3 300 words & fig.)

1927 625 .143.3 (.73)

Railway Age, No. 24, May 14, p. 1449.

Oiling reduces **rail and flange wear** 80 per cent. (2 000 words & fig.)

1927 621 .133.8 (.73)

Railway Age, No. 24, May 14, p. 1459.

Duplex gage equipped with rotating back pressure scale. (300 words & fig.)

1927 621 .139 (.73), 625 .18 (.73) & 625 .27 (.73)

Railway Age, No. 25, May 21, p. 1491.

New York Central handles scrap on **big scale.** (4 200 words & fig.)

1927 625 .111 (.73)

Railway Age, No. 25, May 21, p. 1 501.

Heavy filling projects present unusual problems. (5 000 words & fig.)

1927 621 .133.1 (.73)

Railway Age, No. 25, May 21, p. 1508.

Interest in the **Fuel Association's convention** increasing. (12 000 words, tables & fig.)

1927 656 .284 (.73)

Railway Age, No. 25, May 21, p. 1523.

LAYNG (C.). — **Railways on west bank of Mississippi** suffer heavy flood losses. (4 300 words & fig.)

Railway Engineer. (London.)

1927 625 .26 (.42)

Railway Engineer, June, p. 209.

A progressive system of **railway carriage lifting and repairing.** (3 000 words & fig.)

1927 62. (01

Railway Engineer, June, p. 221.

CATON (E. E.). — Simplified method for **calculating the moment of inertia of a compound section.** (1 200 words, tables & fig.)

1927 625 .214

Railway Engineer, June, p. 228.

Anti-friction bearings for railway rolling-stock. (1 800 words, 2 tables & fig.)

1927 625 .231 (.42)

Railway Engineer, June, p. 232.

New brake vans, London Midland & Scottish Railway. (500 words & fig.)

1927 621 .132.8 (.460)

Railway Engineer, June, p. 235.

New **petrol-driven rail motor cars** for Spain. (1 400 words & fig.)

1927 656 .256.3 (.931)

Railway Engineer, June, p. 237.

Absolute permissive block on the New Zealand Railways. (1 300 words & fig.)

1927 621 .134.3 (.42)

Railway Engineer, June, p. 239.

New type **smokebox regulator** for **superheater locomotives.** (1 000 words & fig.)

Railway Engineering & Maintenance. (Chicago.)

1927 625 .143.3 (.73)
Railway Engineering & Maintenance, May, p. 190.
Rail wear cut 80 per cent by Norfolk & Western flange oiler. (2 300 words & fig.)

1927 625 .13 (.73)
Railway Engineering & Maintenance, May, p. 194.
Erection of girder span imposes serious problem. (2 000 words & fig.)

1927 625 .144.4 (.73)
Railway Engineering & Maintenance, May, p. 201.
ADSIT (C. R.). — **Surfacing track with an end tamping trowel.** (1 000 words & fig.)

1927 625 .154 (.73)
Railway Engineering & Maintenance, May, p. 204.
Kansas City Southern makes short job of replacing turntable. (900 words & fig.)

1927 621 .133.7 (.73)
Railway Engineering & Maintenance, May, p. 209.
KNOWLES (C. R.). — **Cutting the cost of water treatment $2.27 per 100 000 gal.** (1 000 words & fig.)

1927 625 .144.4 (.73)
Railway Engineering & Maintenance, May, p. 211.
Tie scoring machine saves labor on the D. L. & W. (1 800 words & fig.)

Railway Gazette & Railway News. (London.)

1927 656 .254 (.42)
Railway Gazette & News, No. 19, May 13, p. 616.
Train control on the L.N.E.R. (1 700 words, 1 table & fig.)

1927 621 .132.3 (.82) & 656 .222.1 (.82)
Railway Gazette & News, No. 19, May 13, p. 619.
Locomotive performance on the Buenos Ayres Great Southern Railway. (900 words, 3 tables & fig.)

1927 621 .132.8 (.42)
Railway Gazette & News, No. 19, May 13, p. 624.
New steam-propelled rail cars for the London & North Eastern Railway. (500 words & fig.)

1927 656 .253 (.42)
Railway Gazette & News, No. 20, p. 651.
Four-aspect colour light signals and power signalling in practice. (2 300 words & fig.)

1927 625 .232 (.42 + .44) & 656 .222.5 (.42 + .44)
Railway Gazette & News, No. 20, May 20, p. 657.
New route to the Continent. Opening of L.M.S. and A.L.A. service via Tilbury and Dunkirk. (1 000 words & fig.)

1927 621 .132.8 (.42)
Railway Gazette & News, No. 22, June 3, p. 706.
Garratt locomotives for the London Midland & Scottish Railway. (700 words & fig.)

1927 656 .222.5 (.42)
Railway Gazette & News, No. 22, June 3, p. 710.
The « easifind » time-table. (850 words & fig.)

1927 656 .222 (.45 + .493 + .494)
Railway Gazette & News, No. 22, June 3, p. 712.
CORNOCK (W.). — **Continental methods of freight train working.** (3 200 words, 1 table & fig.)

1927 656 .283 (.42)
Railway Gazette & News, No. 22, June 3, p. 722.
Railway accident report. Hull, London & North Eastern: February 14,1927. (4 700 words & fig.)

Railway Magazine. (London.)

1927 656 .222.1 (.42)
Railway Magazine, June, p. 431.
ALLEN (C. J.). — **British locomotive practice and performance.** (4 500 words, 1 table & fig.)

1927 625 .142.2 (.42) & 691 (.42)
Railway Magazine, June, p. 441.
HIND (J. R.). — **Preservation of railway sleepers and timbers.** (1 200 words & fig.)

1927 621 .13 (09.3 (.42)
Railway Magazine, June, p. 445.
BLEASDALE (R. E. M.). — **William Hedley and the Wylam locomotives.** (2 600 words & fig.)

Railway Mechanical Engineer. (New York.)

1927 621 .132.3 (.73)
Railway Mechanical Engineer, May, p. 260.
« Northern Pacific » type locomotives. (1 500 words, 1 table & fig.)

1927 621 .13 & 669 .1
Railway Mechanical Engineer, May, p. 264.
WILLIAMS (F.). — **Metallurgy of locomotive iron and steel.** (1 300 words & fig.)

1927 621 .132.7 (.73)
Railway Mechanical Engineer, May, p. 266.
Six-wheel switchers for the Seabord Air Line. (500 words, 1 table & fig.)

1927 621 .132.8 (.73) & 621 .4 (.73)
Railway Mechanical Engineer, May, p. 268.
Gasoline rail car for Frisco. (1 300 words & fig.)

1927 621 .132.8 (01 & 621 .43 (01
Railway Mechanical Engineer, May, p. 270.
LIPETZ (A. I.). — **Diesel locomotive with gear transmission.** (4 500 words & fig.)

1927 621 .336 (.73)
Railway Mechanical Engineer, May, p. 275.
WHITTAKER (C. G.). — **Layout of apparatus on Virginian electric locomotives.** (1 300 words & fig.)

1927 625 .26 (.73)
Railway Mechanical Engineer, May, p. 280.
Repairing steel cars on the Lehigh Valley. (2 200 words & fig.)

1927 625 .245 (.73)
Railway Mechanical Engineer, May, p. 287.
Large Milwaukee **automobile cars.** (1 100 words, 1 table & fig.)

1927 621 .138.1 (.73) & 725 .33 (.73)
Railway Mechanical Engineer, May, p. 294.
The D. L. & W. engine terminal at East Binghamton, N. Y. (2 500 words & fig.)

1927 621 .132.8 (.73) & 621 .335 (.73)
Railway Mechanical Engineer, May, p. 301.
Motor rail car service on B. & M. (1 800 words & fig.)

1927 621 .133.4 (.73)
Railway Mechanical Engineer, May, p. 309.
Novel fastening for **smokebox netting doors.** (300 words & fig.)

Railway Signaling. (Chicago.)

1927 656 .257 (.73)
Railway Signaling, May, p. 168.
BENDER (F. W.). — C. N. J. completes **interlocking** to safeguard Newark Bay drawbridge. (4 200 words & fig.)

1927 656 .256 (.73) & 656 .257 (.73)
Railway Signaling, May, p. 175.
MORGAN (H. G.). — **Signaling** of I. C. Chicago terminal. (5 400 words & fig.)

1927 385 .4 (.3) & 656 .25 (01 (.3)
Railway Signaling, May, p. 186.
MORKILL (E. F.). — **Organization of railroad signal departments.** (5 300 words & fig.)

South African Railways and Harbours Magazine. (Johannesburg.)

1927 621 .33 (.68)
South African Rys. & Harbours Mag., May, p. 697.
ANDERSON (J. P.). — **Electric traction** in Natal. (2 000 words & fig.)

1927 625 .245 (.68)
South African Rys. & Harbours Mag., May, p. 734.
The evolution of the fruit truck. (1 200 words & fig.)

In Italian.

Annali dei lavori pubblici. (Roma.)

1927 721 .4 (01
Annali dei lavori pubblici, febbraio, p. 142.
BELLUZZI (O.). — **Il teorema di Land** applicato alle deformate quotate (linee d'influenza integrali). (5 200 parole, 1 tabella & fig.)

Annali, sindacato nazionale fascista & engegneri. (Roma.)

1927 721 .9 (.45)
Ann. Sindac. naz. fascista & engegneri, aprile, p. 64.
SANTARELLA (L.). — **Lo sviluppo delle costruzioni in cemento armato in Italia in relazione alle norme ufficiali.** (3 000 parole.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1927 621 .33 (09.1 (.45)
Rivista tecnica delle ferrovie ital., 15 maggio, p. 181.
SOCCORSI (L.). — **La ferrovia elettrica Roma-Ostia.** (6 900 parole & fig.)

1927 656 .254 (.45)
Rivista tecnica delle ferrovie ital., 15 maggio, p. 205.
NOBILI (B.). — **Il dirigente centrale** sulla linea Bologna-Pistoia. (6 500 parole & fig.)

1927 625 .214
Rivista tecnica delle ferrovie ital., 15 maggio, p. 216.
AZZARELLO (E.). — **Rigenerazione degli oli minerali usati.** (5 400 parole, 1 tabella & fig.)

1927 62. (01 (.52) & 625 .143.3 (.52)
Rivista tecnica delle ferrovie ital., 15 maggio, p. 232.
Un nuovo **apparecchio per scoprire i defetti interni delle rotaie.** (800 parole & fig.)

Rivista dei trasporti. (Milano.)

1927 621 .331
Rivista dei trasporti, gennaio-febbraio, p. 2.
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[016 .385 (02]

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Der Brückenbau. Band 3, Hälfte 1. Eiserne Brücken.

Leipzig, Verlag von Johann Ambrosius Barth. Neu bearb. u. erw. Auflage. 4°. VIII-521 Seiten mit 527 Abb. im Text. (Preis : 26 Rm.)

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway Science », by L. Weissenbruch in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1927 62. (01

PASTERNAK (P.).

Berechnung vielfach statisch unbestimmter biegefester Stab- und Flæchenwerke.

Zürich, Verlag von Leemann & Co. (Preis : 13 Schweizer Frank.)

1927 385 .5 (.43)

ROSER (Dr.), Reichsbahndirektionspräsident.

Die Personalordnung (Perso) der Deutschen Reichsbahn-Gesellschaft.

Berlin, Volkskraft Verlagsgesellschaft m. b. H. Vierte vermehrte und verbesserte Auflage.

In English.

1927 621 .9 (02

BARRITT (J. W.)

Care and operation of machine tools.

New York, John Wiley & Sons. (6×9 inches), 292 pages, illus. (Price : $2.75.)

1927 621. (02

Fourth Power Kink Book. Compiled by Editorial Staff of *Power*.

New York, McGraw-Hill Book Co. (6×9 inches), 232 pages, illus. (Price : $1.50.)

1927 313 .385 (.66) & 385. (08 (.66)

GOLD COAST RAILWAY.

Administration report for the year 1926-27.

Sekondi (Gold Coast). Railway Press. Gr. 4°, 62 pages, 12 tables & fig.

1927 621 .3 (02

MEARES (J. W.) & NEALE (R. E.).

Electrical engineering practice. A practical treatise for electrical, civil and mechanical engineers. Vol. II.

London, Chapman and Hall, Limited. 4th edition. (Price : 25 s. net.)

1927 625 .212. (01

MOORE (Herbert F.).

A study of fatigue cracks in car axles. A report of the investigation conducted by the Engineering Experiment Station, University of Illinois in co-operation with Utilities Co-operative Research Committee.

Urbana, Ill. Published by University of Illinois. Bulletin 165, Experiment Station. (Price : 15 cents.)

1927 62. (01 & 669

MOORE (H. F.) & KOMMERS (J. B.).

Fatigue of metals; with chapters on the fatigue of wood and concrete.

New York, Mc Graw-Hill Book Co. (6×9 inches), 326 pages, illus. diagrams, tables. (Price : $4.00.)

1927 385 .51 (.73)

ROBBINS (Hayes).

Human relations in railroading.

New York, Published by the General Publishing Company, 30, Church Street. (5×7 1/2 inches), 160 pages (Price : $2.00.)

1927 621 .33 (.944)

THE INSTITUTION OF ENGINEERS, AUSTRALIA

The electrification of Sydney and Suburban Railways. Series of papers presented before the Institution of Engineers, Australia at Sydney, August to December 1926.

Sydney, Published by the Institution, Macleay House, 16, College Street. One vol. in 8vo (5 3/8×8 1/2 inches), 382 pages with numerous fig. in the text.

1927 624. (02

WATSON (Wilbur J.).

Bridge architecture.

New York, William Helburn, Inc. (11×14 inches), 288 pages, illus. (Price: $17.50.)

1927 669. (02

WYSOR (Henry).

Metallurgy; a general treatise for the use of students of engineering.

Easton, Pa., Chemical Publishing Co. Third edition. (6×9 inches), 433 pages, illus. (Price : $6.00.)

In Italian.

1926 313 .385 (.45) & 385. (08 (.45)

MINISTERO DELLE COMUNICAZIONI (Amministrazione delle Ferrovie dello Stato.)

Relazione per l'anno finanziario 1925-26.

Roma. Provveditorato Generale dello Stato Libreria. In-4°, 346 pagine, con 1 carta.

In Spanish.

1927 721 .9 (02

MARCHESI (J. M.).

Instrucciones para las construcciones de hormigón armado.

Madrid, Ruiz Hermanos. In-8° (125×190) 88 páginas con fig.

In Dutch.

1927 656. (02

BEYEN (K. H.).

Middelen van verkeer te land, te water en door de lucht. Spoorwegen. Zesde en zevende deel der serie : De Rechtskennis van den Ingenieur.

Amsterdam, L. J. Veen.

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II. — PERIODICALS.

In French.

Bulletin technique de la Suisse romande. (Vevey.)

1927 62. (01 & 721 .9 (01

Bull. tech. de la Suisse Romande, n° 15, 16 juillet, p. 181.

GUIDI (C.). — Etudes expérimentales sur des constructions en béton armé. (2 800 mots, 5 tableaux & fig.)

1927 691. (01

Bull. tech. de la Suisse romande, n° 16, 30 juillet, p. 196.

BOLOMEY (J.). — Détermination sur le chantier de la quantité d'eau de gâchage du béton. (800 mots & fig.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1927 385. (09.1 (.438)

Bull. des transp. intern. par ch. de fer, juillet, p. 246.

La réorganisation des chemins de fer en Pologne. (400 mots.)

1927 313 .385 (.481)

Bull. des transp. intern. par ch. de fer, juillet, p. 257.

Statistique des chemins de fer norvégiens pour l'exercice 1925-26. (Tableau.)

Bulletin de l'Union internationale des chemins de fer (Paris).

1927 385 .113 (.47)

Bull. de l'Union intern. des ch. de fer, juin, p. 203.

Les Chemins de fer de l'Etat de Lettonie pendant l'exercice 1924-25. (1 600 mots & tableaux.)

1927 385 .113 (.43)

Bull. de l'Union intern. des ch. de fer, juin, p. 212.

Rapport du commissaire des Chemins de fer allemands sur le deuxième exercice de fonctionnement de la Compagnie (1er janvier-31 décembre 1926). (15 000 mots, tableaux & fig.)

Chronique des transports. (Paris.)

1927 621 .33 (.44)

Chronique des transports, n° 13, 10 juillet, p. 2.

L'électrification du réseau du Midi. (3 700 mots & 2 tableaux.)

1927 385 .113 (.47)

Chronique des transports, n° 13, 10 juillet, p. 40.

L'exploitation des chemins de fer soviétiques en 1926. (1 200 mots.)

Génie civil. (Paris.)

1927 621 .33 (.44)

Génie civil, n° 2346, 30 juillet, p. 105.

L'électrification des Chemins de fer du Midi. Etat actuel des lignes et du matériel. (7 500 mots, 3 tableaux & fig.)

1927 625 .12 & 691

Génie civil, n° 2346, 30 juillet, p. 123.

CHAUDY (F.). — Type de tablier sous voies ferrées en rails hors service enrobés de béton. (1 200 mots & fig.)

Les chemins de fer et les tramways. (Paris.)

1927 621 .132.8 & 621 .43

Les ch. de fer et les tramw., juillet, p. 126.

Locomotives et automotrices Diesel. (3 800 mots, un tableau & fig.)

1927 621 .133.5

Les ch. de fer et les tramw., juillet, p. 130.

Un nouveau dispositif d'échappement pour locomotives. (2 000 mots & fig.)

1927 621 .132.8 (.44)

Les ch. de fer et les tramw., juillet, p. 133.

SPIESS (E.). — Une automotrice à vapeur. (3 700 mots & fig.)

1927 621 .132.8 (.67)

Les ch. de fer et les tramw., juillet, p. 138.

Locomotive Garratt du Chemin de fer du Benguella (voie de 1m.067). (1 000 mots & fig.)

1927 621 .132 (.44)

Les ch. de fer et les tramw., juillet, p. 140.

Quelques locomotives récentes des réseaux français. (350 mots & 2 tableaux.)

1927 625 .144.4

Les ch. de fer et les tramw., juillet, p. 141.

Appareil destiné à mesurer le parallélisme des voies de chemins de fer. (500 mots & fig.)

1927 656 .257

Les ch. de fer et les tramw., juillet, p. 143.

BOURGAIN (A.). — Le moteur Aster à courant triphasé pour aiguilles et signaux. (1 200 mots & fig.)

L'Industrie des voies ferrées et des transports automobiles. (Paris.)

1927 625 .616 (.44) & 625 .617 (.44)

L'Ind. voies ferrées et transp. autom., juillet, p. 327.

ANDRIES. — Les trains réversibles de la Société T. C. R. P. (6 000 mots & fig.)

Revue générale des chemins de fer. (Paris.)

1927 656 .211 (.44)
Revue générale des chemins de fer, août, p. 135.
QUANTIN. — **Transformation de la gare des voyageurs** de Limoges-Bénédictins. (2 700 mots & fig.)

1927 621 .335 (.494)
Revue générale des chemins de fer, août, p. 154.
MEYFARTH (G. L.). — **La nouvelle locomotive du Loetschberg** (Type 1 AAA-AAA 1). (4 500 mots & fig.)

1927 385 .113 (.44)
Revue générale des chemins de fer, août, p. 167.
Les résultats de l'exploitation des cinq grandes compagnies de chemins de fer en 1926. (18 600 mots & tableaux.)

1927 385 .113 (.44)
Revue générale des chemins de fer, août, p. 201.
Résultats obtenus en 1926 sur les réseaux des cinq compagnies principales des chemins de fer français. (8 tableaux.)

1927 625 .5 (.494)
Revue générale des chemins de fer, août, p. 217.
Funiculaire aérien de l'Aiguille de Zug. (850 mots & fig.)

1927 621 .131.3 (.43)
Revue générale des chemins de fer, août, p. 224.
Nouveaux résultats d'essais obtenus sur les locomotives à vapeur des Chemins de fer allemands. (1 400 mots.)

Revue universelle des mines, de la métallurgie, des travaux publics, des sciences et des arts appliqués à l'industrie. (Liége.)

1927 621 .116
Revue universelle des mines, n° 3, 1er août, p. 93.
Le chauffage des chaudières au charbon pulvérisé au moyen d'appareils individuels. (4 200 mots & fig.)

Revue universelle des transports. (Paris.)

1927 385. (09.3 (.44)
Revue univers. des transp., nos 79-80, 10-25 juin, p. 201.
GRAS (L. J.). — **Les premiers chemins de fer français.** (3 000 mots.)

1927 62. (01 & 624 .2 (01
Revue univers. des transp., nos 79-80, 10-25 juin, p. 208.
L'enregistreur d'efforts « Cambridge ». (500 mots & fig.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1927 385 .517 (.43)
Archiv für Eisenbahnwesen, Heft 4. Juli-August, S. 1017.
KUHATSCHECK (O.). — **Die Arbeiterpensionskassen, die Krankenkassen und die Unfallversicherung** bei der Deutschen Reichsbahn im Jahr 1926. (17 000 Wörter u. Tabellen.)

1927 385 .113 (.47)
Archiv für Eisenbahnwesen, Heft 4. Juli-August, S. 1064.
Die russischen Eisenbahnen im Wirtschaftsjahr 1924-25. (3 500 Wörter u. Tabellen.)

1927 385 .113 (.52)
Archiv für Eisenbahnwesen, Heft 4. Juli-August, S. 1088.
Die japanischen Staatseisenbahnen in den Rechnungsjahren 1924-25 und 1925-26, die übrigen japanischen Eisenbahnen im Rechnungsjahr 1924-25. (5 700 Wörter u. Abb.)

1927 313 .385 (.485)
Archiv für Eisenbahnwesen, Heft 4. Juli-August, S. 1103.
Die schwedische Eisenbahnnetz 1920-1924. (Tabellen.)

1927 385 .113 (.489)
Archiv für Eisenbahnwesen, Heft 4. Juli-August, S. 1115.
Die Eisenbahnen in Dänemark im Betriebsjahr 1924-25. (Tabellen.)

Elektrische Bahnen. (Charlottenburg.)

1927 621 .335 (.43)
Elektrische Bahnen, Juli, S. 208.
WECHMANN (W.). — **Neue elektrische Lokomotiven und Triebwagen** für die Deutsche Reichsbahn. (2 000 Wörter, 1 Tabelle u. Abb.)

1927 621 .333
Elektrische Bahnen, Juli, S. 212.
ÉLIÁS (F.). — **Beitrag zur Vorausberechnung der Erwärmungskurven von Triebmotoren elektrischer Fahrzeuge.** (1 800 Wörter u. Abb.)

Glasers Annalen. (Berlin.)

1927 625. 235 & 698
Glasers Annalen, Heft 1, 1. Juli, S. 12.
LORENZ. — **Beitrag zur Anwendung der Farbspritze in der Eisenbahnwerkstatt.** (5 300 Wörter u. Abb.)

1927 621 .138.2 (.43)
Glasers Annalen, Heft 1, 1. Juli, S. 25.
MINDERMANN (K.). — **Ausgeführte Neuerungen im Lokomotivbetriebsdienst.** (850 Wörter u. Abb.)

In English.

Electric Railway Journal. (New York.)

1927 625 .62 (.45)
Electric Railway Journal, No. 1, July 2, p. 5.
BLAKE (H. W.). — Milan improves **local transportation.** (2 500 words & fig.)

1927 621 .336 (.73)
Electric Railway Journal, No. 1, July 2, p. 9.
PICKENS (B. M.). — **Catenary overhead** of the Virginian Railway. (3 000 words, 2 tables & fig.)

1927 621 .335 (.73)
Electric Railway Journal, No. 2, July 9, p. 53.
Electric colossus of rails now hauling Great Northern train. (2 300 words, 1 table & fig.)

1927 621 .336 (.73)
Electric Railway Journal, No. 2, July 9, p. 59.
BIRCH (L. W.). — **Rejuvenating the overhead contact line.** (2 000 words & fig.)

1927 621 .338 (.73)
Electric Railway Journal, No. 4, July 23, p. 138.
New passenger cars bid for patronage on the Cincinnati, Hamilton & Dayton. (3 000 words, 5 tables & fig.)

1927 385 .525 (.73)
Electric Railway Journal, No. 4, July 23, p. 145.
Paying trainmen by check successful. (750 words.)

1927 62. (01 & 625 .143.3
Electric Railway Journal, No. 6, August 6, p. 224.
Corrugation studied at Montreal. (1 600 words, 1 table & fig.)

1927 621 .33 (.45)
Electric Railway Journal, No. 6, August 6, p. 227.
BLAKE (H. W.). — **High-tension d. c. development** in southern Italy. (1 200 words & fig.)

Engineer. (London.)

1927 621 .132.3 (.44)
Engineer, No. 3732, July 22, p. 98.
MONKSWELL (Lord). — The work of the new **compound locomotives of the Nord Railway.** (2 700 words.)

1927 621 .116. (01
Engineer, No. 3733, July 29, p. 120.
WOHLENBERG (W. J.) & BROOKS (F. W.). — The design of **boiler furnaces.** (3 000 words & fig.)

1927 625. 143.2 & 669.1
The Metallurgist, p. 104, Supplement to the Engineer, No. 3733, July 29.
The **heat treatment of steel rails.** (1 900 words, 2 tables & fig.)

1927 62. (01
The Metallurgist, p. 105, Supplement to the Engineer, No. 3733, July 29.
Elastic hysteresis. (1 600 words & fig.)

1927 62. (01
The Metallurgist, p. 107, Supplement to the Engineer, No. 3733, July 29.
The effect of **torsion and bending on soft steel.** (1 200 words, 3 tables & fig.)

1927 621 .87 (.42) & 656 .212.6 (.42)
Engineer, No. 3735, August 12, p. 184.
New **coal hoists** in South Wales. (1 200 words & fig.)

Engineering. (London.)

1927 625 .13 (.54)
Engineering, No. 3209, July 15, p. 65.
NICHOLLS (H. J.). — **Replacement of verticals in a 216-ft. span pratt truss bridge.** (2 000 words & fig.)

1927 621 .335
Engineering, No. 3210, July 22, p. 95.
The design of **coupling rods** for **electric locomotives.** (5 000 words, 3 tables & fig.)

1927 621 .132.5 (.73)
Engineering, No. 3210, July 22, p. 102.
4-10-2 type three-cylinder Compound locomotive. (1 100 words & fig.)

1927 656 .211.7 (.42)
Engineering, No. 3210, July 22, p. 107.
Motor ferry boat for the Southern Railway Company. (1 000 words & fig.)

1927 621 .33 (.944)
Engineering, No. 3211, July 29, p. 125.
The **electrification** of the Sydney Metropolitan Railways. (2 000 words.)

1927 385 .15 (.54)
Engineering, No. 3211, July 29, p. 130.
Indian railway progress. (3 900 words.)

1927 62. (01
Engineering, No. 3211, July 29, p. 141.
Magnetic testing. (2 700 words.)

1927 62. (01 & 669.1
Engineering, No. 3211, July 29, p. 148.
HADFIELD (Sir Robert). — **Alloys of iron and manganese** containing low carbon. (4 000 words, tables & fig.)

1927 621 .132.5 (.66)
Engineering, No. 3213, August 12, p. 198.
2-8-2 type locomotive for the Kenya and Uganda Railway. (650 words & fig.)

1927 62. (01
Engineering, No. 3213, August 12, p. 215.
SWIFT (H. W.). — The **strength of cast in joints.** (2 500 words, 1 table & fig.)

1927 621 .116 & 669.1
Engineering, No. 3213, August 12, p. 216.
PARR (S. W.) & STRAUB (F. G.). — **Embrittlement of boiler plate.** (4 100 words & fig.)

1927 621 .94 (.42)
Engineering, No. 3213, August 12, p. 218.
6 1/2 inches centre friction-geared **turret lathe.** (1 100 words & fig.)

Engineering News-Record. (New York.)

1927 62. (01 & 669.1
Engineering News-Record, No. 1, July 7, p. 26.
Effect of **sulphur on plate steel.** (350 words & fig.)

1927 624 .1 (.73)
Engineering News-Record, No. 2, July 14, p. 48.
JUDD (E. I.). — **Floating-caisson construction** of bascule bridge piers. (4 700 words & fig.)

1927 624 .1 (.73)
Engineering News-Record, No. 3, July 21, p. 92.
CARSWELL (C.). — **Deep steel sheetpile cofferdams** at Arlington Bridge. (1 500 words & fig.)

1927 62. (01 & 669
Engineering News-Record, No. 3, July 21, p. 94.
Research in the **fatigue of metals.** (2 800 words, 2 tables & fig.)

1927 625 .13 (.71) & 627 (.71)
Engineering News-Record, No. 4, July 28, p. 128.
McEWEN (A. B.). — Combined **railway bridge** and dam built at outlet of Grand Lake, Newfoundland. (4 200 words & fig.)

1927 624 .52 (.71)
Engineering News-Record, No. 4, July 28, p. 150.
Montreal South Shore **cantilever bridge** under construction. (1 200 words & fig.)

1927 625 .13 (.73) & 621 .39 (.73)
Engineering News-Record, No. 5, August 4, p. 176.
ROOF (W. R.). — Welded material strengthens old **railway truss bridge.** (1 200 words & fig.)

1927 621 .132 8 (.73)
Engineering News-Record, No. 5, August 4, p. 190.
Articulated locomotive operates on 7 1/2 per cent grades. (800 words & fig.)

Great Western Railway Magazine. (London.)

1927 656 .213.5 (.42)
Great Western Railway Magazine, August, p. 315.
Development of **South Wales ports.** (2 000 words & fig.)

1927 385 .517 .6 (.42)
Great Western Railway Magazine, August, p. 321.
GREENWOOD (H. H.). — **Great Western hospital** work at Swindon. (2 800 words.)

Journal of the Institute of Transport. (London.)

1927 656 .2 (01 (.42)
Journal of the Institute of Transport, July, p. 402.
FOLLOWS (J. H.). — **Traffic control.** (16 000 words & fig.)

1927 656 (.42)
Journal of the Institute of Transport, July, p. 423.
CADBURY (G.). — **Industry and transport.** (12 500 words.)

1927 656 .1 (.42)
Journal of the Institute of Transport, July, p. 437.
SHRAPNELL-SMITH (E. S.). — Highway **costs per ton-mile of traffic.** (14 000 words & 2 tables.)

1927 656. (09.3 (.42)
Journal of the Institute of Transport, July, p. 454.
GRANT ROBERTSON (C.). — **Transport in England:** A brief historical survey. (10 500 words.)

Locomotive Railway Carriage & Wagon Review. (London.)

1927 621 .132.5 (.493)
Loc. Ry. Carriage & Wagon Review, July 15, p. 212.
JACQUET (A.). — **Goods locomotive type 36,** Belgian National Railway Company. (1 500 words & fig.)

1927 625 .213
Loc. Ry. Carriage & Wagon Review, July 15, p. 223.
SANDERS (T. H.). — **Springs** with auxiliary arrangements. (2 000 words & fig.)

Mechanical Engineering. (New York.)

1927 656 .223.2 (01
Mechanical Engineering, August, p. 857.
SILLCOX (L. K.). — Balancing factors in the use and obligations covering **ownership of freight-train cars.** (13 000 words, 6 tables & fig.)

1927 385. (07.1 (.73)
Mechanical Engineering, August, p. 886.
THOMAS (F. W.). — **Railway Apprenticeship** in a national apprenticeship plan. (4 000 words.)

1927 385. (07.1 (.73)
Mechanical Engineering, August, p. 889.
WALKER (P. F.). — **Education for the industries.** (5 800 words.)

1927 385. (07.1 (.73)
Mechanical Engineering, August, p. 893.
HARTLEY (L. A.). — **Industrial problems or difficulties.** (6 800 words.)

1927 536
Mechanical Engineering, August, p. 898.
McMILLAN (L. B.). — **Heat transfer through insulation** in the modernate and high temperature fields : a statement of existing data. (7 800 words & fig.)

Modern Transport. (London.)

1927 625 .251 (.4)
Modern Transport, No. 435, July 16, p. 4.
Continuous brakes for freight trains. (1 100 words.)

1927 625 .61 (09.1 (.42)
Modern Transport, No. 435, July 16, p. 5.
Smallest public railway in the world. (1 500 words & fig.)

1927 385 .1 (.67)
Modern Transport, No. 436, July 23, p. 5.
Railway progress in Kenya and Uganda. (2 300 words & fig.)

1927 385 .1 (.498)
Modern Transport, No. 438, August 6, p. 3.
Railway progress in Rumania. (1 700 words.)

1927 385. (09.1 (.42)
Modern Transport, No. 438, August 6, p. 4.
DALBY (W. E.). — Developments of British Railways. (1 300 words & fig.)

1927 621 .131.3 (.44)
Modern Transport, No. 439, August 13, p. 3.
Locomotive experiments on P. L. M. Railway. Ninety-four « Mountain » type engines to be constructed. (1 500 words & fig.)

1927 385. (09.1 (.67)
Modern Transport, No. 439, August 13, p. 4.
Railway progress in South-East Africa. (1 700 words & fig.)

Railway Age. (New York.)

1927 625 .245 (.73)
Railway Age, No. 1, July 2, p. 6.
M.-K.-T. automobile cars with 12-ft. side doors. (800 words & fig.)

1927 625 .142.3 (.73)
Railway Age, No. 1, July 2, p. 19.
Delaware & Hudson tests scrap-rail ties. (1 000 words & fig.)

1927 624 .8 (.73)
Railway Age, No. 2, July 9, p. 47.
Santa Fe builds new bridge over Mississippi River. (5 300 words & fig.)

1927 621 .139 (.73), 625 .18 (.73) & 625 .27 (.73)
Railway Age, No. 2, July 9, p. 54.
BON (I. C.). — Wabash has well equipped reclamation plant. (1 500 words & fig.)

1927 656 .212 (.73)
Railway Age, No. 2, July 9, p. 59.
How freight traffic is handled in the Chicago terminals. (2 300 words, 6 tables & fig.)

1927 621 .133.5 (.73)
Railway Age, No. 2, July 9, p. 63.
Forced draft through closed ash pans in locomotives. (750 words & fig.)

1927 656 .253. (01 (.73)
Railway Age, No. 2, July 9, p. 69.
ELLIS (G. E.). — The statuts of train control. (2 400 words.)

1927 656 .256.3 (.73)
Railway Age, No. 3, July 16, p. 91.
Seabord proves value of signals. (4 000 words, 1 table & fig.)

1927 621 .43 (.73)
Railway Age, No. 3, July 16, p. 99.
ARTHUR (W.). — Diesel Traction for railroads. (2 000 words, 1 table & fig.)

1927 625 .143.3 (.73)
Railway Age, No. 3, July 16, p. 107.
Stress in rails has important bearing on failures. (1 500 words & fig.)

1927 656 .212.8 (.73)
Railway Age, No. 4, July 23, Section one, p. 136.
Pennsylvania builds the first plate fulcrum master scale. (3 600 words & fig.)

1927 385. (07 .13 (.43)
Railway Age, No. 4, July 23, Section one, p. 141.
WILCOX (U. V.). — Psychological tests on the German Railways. (450 words & fig.)

1927 621 .33 (01 (.4)
Railway Age, No. 4, July 23, Section one, p. 142.
HEALY (K. T.). — Factors which influence electrification in Europe. (2 700 words, 2 tables & fig.)

1927 313 .385 (.3)
Railway Age, No. 4, July 23, Section one, p. 147.
Railway mileage of the World. (Tables.)

1927 621 .133.4 (.73)
Railway Age, No. 4, July 23, Section one, p. 149.
Smokebox designed to prevent air leaks. (1 000 words & fig.)

1927 625 .232 (.73)
Railway Age, No. 4, July 23, Section one, p. 151.
Reading buys special passenger equipment. (1 200 words & fig.)

1927 621 .132.7 (.73)
Railway Age, No. 4, July 23, Section one, p. 153.
A new switching locomotive. (500 words, 1 table & fig.)

1927 656 .1 (.73) & 656 .2 (.73)
Railway Age, No. 4, July 23, Section two, p. 173.
Superintendents favor motor vehicle as railroad auxiliary. (2 300 words & fig.)

1927 625 .143.5 (.73)
Railway Age, No. 5, July 30, p. 211.
An eccentric tie plate without a long heel. (500 words & fig.)

1927 621 .133.7 (.73)
Railway Age, No. 5, July 30, p. 213.
A new treating plant for **locomotive water supplies.** (800 words & fig.)

1927 656 .212 (.73)
Railway Age, No. 5, July 30, p. 214.
FERTIG (H. R.). — Close supervision cuts **yard expense.** (3 600 words, 3 tables & fig.)

1927 621 .134.2 (01
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La **soudure autogène** des foyers en cuivre. (1 300 mots & fig.)

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ALLIX (G.). — **Chemins de fer français et Chemins de fer allemands en 1926**. (3 200 mots & 3 tableaux.)

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MÜLLER (W.). — Beitrag zur **Berechnung eiserner Gittermaste für Querseilaufhängung von Fahrleitungen.** (800 Wörter u. Abb.)

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Aus dem Geschäftsbericht der **Deutschen Reichsbahn-Gesellschaft für das Jahr 1926.** (2 700 Wörter.)

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FEIST (G.). — Das Oelschaltgetriebe System « S.W. » und seine Verwendung im **Triebwagenbau.** (1 300 Wörter u. Abb.)

1927 621 .97

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HEALY (K. T.). — **Electrification** of Swedish State Railway extended. (1 800 words, 1 table & fig.)

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Energy used for traction steadily increases. (950 words, 1 table & fig.)

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BLAKE (H. W.). — Overhaul by **conveyor platform.** (2 200 words & fig.)

1927 621. 333

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McCLOSKEY (F. W.). — Methods used to prevent **breakage of armature leads.** (2 300 words & fig.)

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JAMES (G. W.). — Seven months of **car building.** (2 700 words, 1 table & fig.)

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SWIFT (H. W.). — **A graphical analysis of stress.** (3 900 words & fig.)

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The **railway position.** (1 500 words.)

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The Prandtl-Nadai torsion theories and their applications. (600 words & fig.)

1927 624 .32 (.43)

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Engineering, No. 3214, August 19, p. 232.
MacArthur compressed concrete piles. (2 000 words & fig.)

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PARKER (J. W.). — Railway rates and the « appointed day ». (1 400 words.)

1927 621 .134.2
Engineering, No. 3216, September 2, p. 292.
Beardmore-Caprotti valve gear tests. (1 500 words, 1 table & fig.)

1927 621 .116 (.55)
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Brackish water as feed for water-tube boilers. (900 words.)

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STANTON (T. E.). — The lubrication of surfaces under high loads and temperatures. (2 800 words & fig.)

1927 621 .116
Engineering, No. 3217, September 9, p. 325.
Hagan automatic boiler control. (4 500 words & fig.)

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BROWNLIE (D.). — Boiler feed water treatment. (2 400 words.)

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BENEDICKS (C.). & LOFQUIST (H.). — Theory of the growth of cast iron repeatedly heated. (2 300 words.)

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1927 624 .51 (.73)
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Design of 3 500-ft. suspension bridge across Hudson river. (3 900 words & fig.)

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Progress of the Cascade tunnel, Great Northern Railway. (1 000 words, 1 table & fig.)

1927 625 .111 (.73)
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New Texas railroad for Rock Island lines. (2 400 words, 2 tables & fig.)

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PAASWELL (G.). — Open-cut subway, New York City, built under unusual conditions. (2 500 words & fig.)

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SCOTT (W. L.). — Long concrete bowstring bridge erected in France. (1 000 words & fig.)

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SEILER (J. F.). — Concrete cantilever bridge with flexible expansion bearings. (1 600 words & fig.)

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Open dredging sinks deep piers for African railway bridge. (400 words & fig.)

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Rapid-Transit railway at Sydney, Australia. (1 500 words & fig.).

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WALLACE (L. W.). — Accidents and production. (3 500 words.)

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LITTLE (A. D.). — Impending changes in our use of fuels. (3 800 words.)

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RUNGE (R. F.). — Recent developments in the application of anti-friction bearings to machine tools. (3 500 words & fig.)

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BRAUER (F.). — **Anti-friction bearings** in ordnance work. (5 300 words, 1 table & fig.)

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CURTIS (M. S.). — The economics of machine-tool replacement. (3 500 words, 4 tables & fig.)

1927 621 .7 (01
Mechanical Engineering, September, p. 970.
MORROW (L. C.). — **Shop equipment policies** in representative plants. (5 600 words.)

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POWELL (S. T.). — **Boiler-feedwater problems** and methods of treatment. (5 200 words.)

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Railways and road carrying powers. (2 200 words & fig.)

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Reconstruction of North Seaton viaduct, L. N. E. R. (3 100 words & fig.)

1927 621 .131 .2 (.42)
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KING (C. R.). — **Locomotive development** on British Railways. (3 700 words.)

1927 621 .132 .8 (.42)
Modern Transport, No. 441, August 27, p. 7.
Light power units for railway service. (1 700 words & fig.)

1927 621 .132 .6 (.42)
Modern Transport, No. 442, September, 3, p. 3.
Southern Railway « **River** » class locomotives. (1 000 words & fig.)

1927 656 .1 (.73) & 656 .2 (.73)
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Railways and roads in the United States. (1 800 words.)

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JOY (B.). — **Engine lubrication.** (1 900 words & fig.)

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Modern Transport, No. 442, September 3, p. 17.
Underground **railway rolling stock.** (750 words & fig.)

1927 656 .257 (.42)
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New power interlocking system on the G. W. R. (2 500 words & fig.)

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THOMAS (G. K.) & LISTON (R. E.). — **Santa Fe train control aids traffic.** (4 600 words & fig.)

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Railway Age, No. 6, August 6, p. 256.
Illinois Central builds large **shops at Paducah.** (3 400 words & fig.)

1927 625 .232
Railway Age, No. 6, August 6, p. 261.
Proposed **sleeping car** designed for maximum confort. (600 words & fig.)

1927 621 .132 .7 (.73)
Railway Age, No. 6, August 6, p. 265.
Eight-wheel **switch engine** with large boiler capacity. (1 000 words, 2 tables & fig.)

1927 656 .212 (.73) & 725 .32 (.73)
Railway Age, No. 7, August 13, p. 285.
Pennsylvania Railroad builds country's largest **express terminal.** (5 000 words & fig.)

1927 659 (.73)
Railway Age, No. 7, August 13, p. 291.
Unique solicitation methods result in increased revenue. (2 500 words & fig.)

1927 621 .139 (.73), 625 .18 (.73) & 625 .27 (.73)
Railway Age, No. 7, August 13, p. 294.
Younger P. and S. men air views on material handling. (3 200 words & fig.)

1927 621 .137 .3 (.73)
Railway Age, No. 7, August 13, p. 296.
Double and triple crewing switch engines on the Frisco. (500 words.)

1927 621 .336 (.73)
Railway Age, No. 7, August 13, p. 297.
THOMPSON (F. R.). — **Contact system** mounted on springs. (2 400 words & fig.)

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Railway Age, No. 7, August 13, p. 301.
Special car equipment for Union Pacific. (800 words & fig.)

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Railway Age, No. 7, August 13, p. 302.
Viloco redesigned and sander operating valve. (300 words & fig.)

1927 625 .245 (.73)
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Automatic two-way side hinged dump car. (1 100 words & fig.)

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Railway Age, No. 8, August 20, p. 323.
Pre-classification. (450 words.)

1927 656 .254 (.73)
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SCHWENDT (B. J.). — N. Y. C. installs first complete train dispatching system. (2 900 words & fig.)

1927 656 .254 (.73)
Railway Age, No. 8, August 20, p. 330.
Improved train indicators on Brooklyn Subways. (650 words & fig.)

1927 656 .223 .2 (.73)
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GORMLEY (M. J.). — An outstanding record of achievement. (1 800 words.)

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Track depression work at Detroit imposes many problems. (3 400 words & fig.)

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Railway Age, No. 8, August 20, p. 339.
PARKS (C. E.). — Cost accounting and the operating expense classification. (3 100 words.)

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D. & H. remodels parlor-cafe car. (700 words & fig.)

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Railway Age, No. 9, Section one, August 27, p. 367.
MANN (B. H.). — The importance of accelerating freight train movement. (1 700 words & fig.)

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Dining cars for the D. & R. G. W. (900 words & fig.)

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HASTINGS (E. M.). — Piers show no depreciation after 85 years' service. (1 000 words & fig.)

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Railway Age, No. 9, Section one, August 27, p. 375.
Erie uses bill posting methods in material campaign. (2 200 words & fig.)

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RAYMER (I. S.). — P. & L. E. trains call for route by microphone. (500 words & fig.)

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Forsyth friction draft gear. (450 words & fig.)

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Railway Engineer, September, p. 328.
Standard type vehicles for heavy merchandise, L. M. S. R. (900 words & fig.)

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FIEGEHEN (E. G.). — Railway breakdown cranes. (2 600 words.)

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Interlocking of opening bridges. (1 600 words & fig.)

1927 621 .335 (.54) & 621 .338 (.54)
Railway Engineer, September, p. 335.
New steel electric rolling-stock for India. (1 300 words & fig.)

1927 725 .43 (.42)
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New boiler shops at Gorton Foundry, Manchester. (1 900 words & fig.)

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New 4-6-0 type express passenger engines, L. M. S. R. (500 words & fig.)

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1927 656 .283 (.42)
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A modern locomotive improved. (500 words & fig.)

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The development of the **steam rail motor car.** (2 300 words & fig.).

1927 385 .15 (.493)
Railway Gazette & News, No. 9, August 26, p. 250.
NEIL (L. H. K.). — **The reorganisation of the Belgian Railways.** (3 700 words.)

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New **locomotive depot** at Mayne Junction, Queensland Railways. (700 words & fig.)

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HARCAVI (G.). — **Locomotive standardisation** in Germany. (2 000 words, 3 tables & fig.)

1927 625 .123 (.42)
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Thrust-boring for drainage purposes. (1 300 words & fig.)

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Cylinder losses in **compound locomotives.** (2 000 words & fig.)

1927 621 .132 .5 (.54)
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New 2-8-2 locomotives, Assam-Bengal Railway. (300 words & fig.)

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German **train indicators.** (200 words & fig.)

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WHITE (J. D.). — **Road motor transport** in South Africa. (2 000 words & fig.)

1927 621 .133 .4
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A new type **smokebox regulator** for superheater locomotives. (1 000 words & fig.)

1927 621 .335 (.44)
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Test of Oerlikon **electric locomotives,** Paris-Orléans Railway. (400 words & fig.)

1927 656 .213 (.42)
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Great Western Railway **docks and harbours.** (2 800 words, 2 tables & fig.)

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Heavy loads on a narrow-gauge line. (300 words & fig.)

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ALLEN (C. J.). — **British locomotive practice and performance.** (4 500 words, 4 tables & fig.)

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FRY (L. H.). — **High pressure steam locomotives.** (4 900 words, 2 tables & fig.)

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Smokebox prevents air leaks. (1 000 words & fig.)

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Canadian National buys **4-8-4 type locomotives.** (2 700 words, 1 table & fig.)

1927 385 .586 (.73)
Railway Mechanical Engineer, August, p. 541.
ROBBINS (H.). — A new undertaking in **apprentice training.** (5 300 words.)

1927 625 .245 (.73)
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Fifty-ton automobile cars for the Missouri-Kansas-Texas. (800 words, 1 table & fig.)

1927 625 .26 (.73)
Railway Mechanical Engineer, August, p. 551.
Nickel plate **repairs automobile cars** at Conneaut. (2 000 words & fig.)

1927 621 .138 .5 (.73)
Railway Mechanical Engineer, August, p. 555.
Boston & Albany blacksmith shop at West Springfield. (1 200 words & fig.)

1927 621 .138 .5 (.73) & 725 .33 (.73)
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New B. & M. boiler shop at Billerica. (1 000 words & fig.)

South African Railways and Harbours Magazine. (Johannesburg.)

1927 385. (09 .1 (.68)

South African Rys. & Harbours Mag., August., p. 1283.

The Railways of Rhodesia. (2 300 words & fig.)

In Italian.

Annali dei lavori pubblici. (Roma.)

1927 621 .8 (.45) & 627 (.45)

Annali dei Lavori Pubblici, giugno, p. 497.

FERRO (G.). — Lo sviluppo degli arredamenti meccanici nei maggiori porti italiani. (17 500 parole, 2 tabelle & fig.)

1927 62. (01

Annali dei Lavori Pubblici, giugno, p. 545.

KRALL (G.). — Un metodo di riduzione dei parametri di un sistema elastico e sue applicazioni nella dinamica delle costruzioni. (5 200 parole.)

1927 625 .255

Annali dei Lavori Pubblici, giugno, p. 568.

Il freno elettropneumatico Pieper. (2 600 parole & fig.)

L'Ingegnere. (Roma.)

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L'Ingegnere, agosto, p. 66.

VITALE (A.). — I principali porti italiani nella loro consistenza tecnica. (7 000 parole, 1 tabella & fig.)

1927 656 .1 (.45) & 656 .2 (.45)

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SLING. — Consistenza attuale dei trasporti ferroviari ed automobilistici in Italia. (3 500 parole, 6 tabelle & fig.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1927 625 .122 (.45)

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SEGRE (C.). — Studi geognostici interessanti la ferrovia valdostana. (24 000 parole & tavole.)

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1927 621 .131 .1

Rivista dei Trasporti, luglio, p. 103.

MAFFEZZOLI (A.). — Sulle curve di accelerazione. (400 parole & fig.)

In Spanish.

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1927 385 .4 (.82)

Boletin de Obras Públicas, julio, p. 561.

Funcionamiento y organizacion de las oficinas de la Direccion de ferrocarriles. (2 800 palabras.)

Revista de Obras Públicas. (Madrid.)

1927 624 .63 (.45)

Rivista de Obras Públicas, n° 17, 1° de sept., p. 332.

RIBERA (J. E.). — Puente de la Victoria, sobre el Pioverna, en Cremeno (Italia). (700 palabras & fig.)

In Dutch.

De Ingenieur. (Den Haag.)

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De Ingenieur, n° 33, 13 August, p. 724.

GARTNER (K.). — Djatihout als locomotiefbrandstof. (3 000 woorden & fig.)

1927 621 .333

De Ingenieur, n° 34, 20 August, p. 743.

PUNGA (F.) & SCHÖN (L.). — Het nieuwe tractiesysteem, waarbij de rijdraad gevoegd wordt met éénfase wisselstroom van 50 perioden. (3 000 woorden & fig.)

1927 624 .8 (01

De Ingenieur, n° 37, 10 September, p. 799.

LEM (D. Y.). — De invloed van den grendel op de steunpuntreacties en het maximum moment bij dubbele bascule bruggen. (750 woorden & fig.)

In Polish.

INŻYNIER KOLEJOWY. (Warszawa.)

1927 625 .611 (.438)

Inzynier Kolejowy, 1 Wrzesnia, str. 249.

SZTOLCMAN (S.). — Koszta wlasne przewozow na panstwowych kolejach waskotorowych w 1925 roku. (3 000 slowa & 15 tablice.)

1927 621 .133 .1 (.438) & 625 .245 (.438)

Inzynier Kolejowy, 1 Wrzesnia, str. 267.

SWIESCIAKOWSKI (T.). — Wagon doswiadczalny gospodarki cieplnej i pierwsze badania instalacji cieplnych na P. K. P. (2 200 slowa, 3 tablice & rys.)

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[016 .385 (02]

I. — BOOKS.

In French.

1927 621 .33 (02

BARBILLION (L.), professeur à l'Université de Grenoble, directeur de l'Institut polytechnique.

Modes spéciaux de traction électrique à courant continu.

Paris, Albin Michel, éditeur, 22, rue Huyghens. In-8°, broché, de 128 pages avec 63 fig. (Prix : 10 francs.)

1927 691. (02

BLANC (E. C.), ingénieur A. M.

Le ciment Portland. Ciments Portland artificiels. Ciments de laitier. Ciments alumineux. Ciments à hautes résistances.

Paris (6e), 15, rue des Saints-Pères; Liège, rue des Dominicains, 8, Librairie polytechnique Ch. Béranger. In-8° (160 × 250) de 481 pages, 190 fig. (Prix : 110 fr.)

1927 621 .3 (02

BOUTHILLON (Léon), ingénieur en chef des Télégraphes, répétiteur à l'Ecole polytechnique, et

GOUDONNET (M.), directeur de l'Ecole pratique de radioélectricité.

Cours pratique d'électricité industrielle. Tome II : Machines et appareils électriques.

Paris (6e), Gauthier-Villars & Cie, 55, quai des Grands-Augustins. In-8° de x-324 pages avec fig. (Prix : 20 francs.)

1927 621 .35 (02

CASTEX (A.), ingénieur, professeur à l'Institut polytechnique de Grenoble.

Accumulateurs électriques.

Paris, Albin Michel, éditeur, 22, rue Huyghens. In-8°, broché, de 296 pages, avec 222 fig. (Prix : 30 francs.)

1927 385 .1 (02

CENDRE (Pierre), docteur en droit.

Le concours des collectivités publiques en matière de chemins de fer.

Paris, Les Presses Universitaires de France, 49, boulevard Saint-Michel. In-8°, 186 pages.

1927 621 .8 (02

CHAMPLY (R.), mécanicien-électricien.

Nouvelle encyclopédie pratique des constructeurs mécaniciens, électriciens, chaudronniers. Tome III : Organes de transmission. Tome IV : Appareils de levage. Manutention et transport. Tome V : Engrenages et vis sans fin.

Paris (6e), 15, rue des Saints-Pères; Liège, rue des Dominicains, 8. Librairie polytechnique Ch. Béranger. In-8° (120 × 180). Tome III : 250 pages, 201 fig. (Prix : 25 francs.). Tome IV : 231 pages, 263 fig. (Prix : 25 francs). Tome V : 253 pages, 182 fig. (Prix : 25 fr.)

1927 621 .115. (02 & 621 .116. (02

CORDIER (F.), colonel, chef de travaux pratiques à l'Ecole polytechnique.

Chaudières et condenseurs.

Paris (6e), Gaston Doin & Cie, éditeurs, 8, place de l'Odéon. In-8° de 664 pages avec 321 fig. (Prix : 70 fr.)

1927 621 .2 (02

FRANCHE (G.), ingénieur A. et M. et E. C. P.

Manuel de l'ouvrier mécanicien. Tome VIII. Moteurs hydrauliques.

Paris (6e), Gauthier-Villars & Cie, 55, quai des Grands-Augustins. In-16, 134 pages avec fig. (Prix : 15 francs.)

1927 621. (02

FRANCHE (G.), ingénieur A. et M. et E. C. P.

Manuel de l'ouvrier mécanicien. Tome XII. La précision en mécanique.

Paris (6e), Gauthier-Villars & Cie, 55, quai des Grands-Augustins. In-16, 119 pages avec fig. (Prix : 15 francs.)

1927 531. (02

MOULAN (Ph.), ingénieur, professeur de mécanique à l'Ecole industrielle de Seraing (Belgique).

Cours de mécanique élémentaire à l'usage des écoles industrielles. Sixième édition, revue et notablement augmentée par **C. Gerday**, ingénieur-mécanicien, professeur de mécanique à l'Ecole industrielle de Seraing.

Paris (6e), 15, rue des Saints-Pères; Liège, rue des Dominicains, 8. Librairie polytechnique Ch. Béranger. In-8° (120 × 190) de 1 349 pages avec 1 410 fig. (Prix : 87 francs.)

[1] The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International of Brussels. See « Bibliographical Decimal Classification as applied to Railway Science », by L. Weissenbruch in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1927 621 .6 (02

WIESMANN (R.), Dr. Ingénieur.

Les ventilateurs. Calculs, tracés et applications. Traduit de l'allemand par M. Pelet, ingénieur, E. I. L.

Paris (6e), Dunod, 92, rue Bonaparte. (160 × 250), x-272 pages, 140 fig. (Prix : 48 francs.)

In German.

1927 385. (02 (.43)

Das Deutsche Eisenbahn-Adressbuch. Bearbeitet vom Verband der Ingenieure der Reichsbahn E. V.

Berlin, Verlag H. Apitz. 650 Seiten. (Preis : 15 Rm.)

1927 691. (02

GRUEN (Richard).

Der Zement. Herstellung, Eigenschaften u. Verwendg.

Mailand (Italien), Libreria Internazionale Ulrico Hoepli, Galleria De Cristoforis. 8°. ix + 173 Seiten mit 90 Textabb. u. 35 Tab. (Preis : Lire 67.50.)

1927 669 .1 (02

HENNING (H. R.), Ober.-Ing.

Die Betriebspraxis der Eisen-, Stahl- und Metallgiesserei. Heft 5, Der Holzmodellbau.

Halle, Verlag Wilhelm Knapp. (Preis : 3.20 Rm.)

1927 62. (02

JANSSEN (Theodor).

Der Bauingenieur in der Praxis. Eine Einf. in d. wirtschaftl. u. prakt. Aufgaben d. Bauingenieurs.

Mailand (Italien), Libreria Internazionale Ulrico Hoepli, Galleria De Cristoforis, 2., neubearb. u. erw. Aufl. Gr. 8°, v + 495 Seiten mit Fig. u. zahlr. eingedr. Tab. (Preis : Lire 105.75.)

1927 624 .2 (02

KAMMER (Emil).

Der durchlaufende Träger über ungleichen Oeffnungen.

Berlin W. 9, Verlag von Julius Springer. 8°. 270 Seiten mit 4 Platten. (Preis : 25.50 Rm.)

1927 613 .66

MARTENS (Hans A.), Dr.

Industrielle Unfallverhütung auf der Grundlage der wissenschaftlichen Betriebsführung.

Berlin, Verlag von Reimar Hobbing. 8°. 100 Seiten mit 15 Abb. (Preis : 2.50 Rm.)

1927 621 .133.7 (02

RÜHL (C.).

Die Speisewasservorwärmung mittels Kesselabgasen. Entwicklg., Konstruktion u. Berechng. des Economisers.

Leipzig, Verlag von Johann Ambrosius Barth. 8°. xix, 265 Seiten mit 152 Textabb., 22 Tabellen, 21 Rechngsbeips. u. 31 Tafeln. (Preis : 14 Rm.)

1927 656. (02

SARTER (Dr. Adolf), Präsident der Reichsbahndirektion Trier.

Verkehrswerbung bei den Eisenbahnen.

Berlin, Verlag der Verkehrswissenschaftlichen Lehrmittelgesellschaft m. b. H. bei der Deutschen Reichsbahn. (150 × 210), 218 Seiten mit 8 vierfarbigen Tafeln. (Preis : 10.80 Rm.)

1927 621 .33 (02

SCHWAIGER (Anton).

Elektrische Bahnen.

Mailand (Italien), Libreria Internazionale Ulrico Hoepli, Galleria De Cristoforis. Kl. 8°, 116 Seiten mit 45 Abb. (Preis : Lire 6.75.)

1927 721 .9 (02

STRIEPLING (A.).

Elemente des Eisenbaues. Grundlagen f. d. Berechnen u. Entwerfen von Eisenbauwerken unter Berücks. d. « Normen f. Eisenbau ».

Leipzig, Verlag von Johann Ambrosius Barth. 8°. vi-104 Seiten mit 136 Textabb., 3 Tafeln u. 28 Berechnungsbeisp. (Preis : 3.80 Rm.)

1927 621 .111. (02

VATER (R.).

Die Dampfmaschine. I. Wirkungsweise d. Dampfes im Kessel u. in d. Maschine.

Leipzig, Verlag von Johann Ambrosius Barth. 6. Auflage, bearbeitet von F. Schmidt. Klein 8°. vi, 108 Seiten mit 38 Abb. (Preis : 2 Rm.)

1927 621 .33 (02 & 656 .254. (02

WECHMANN (Wilhelm), Reichsbahndirektor.

Die Beeinflussung des Fernmeldebetriebs durch elektrische Bahnen.

Charlottenburg, 5. Rom-Verlag (R. Otto Mittelbach). (Preis : 10 Rm.)

In English.

1927 51 (08

A pocket-book of electrical rules and tables for the use of electricians and engineers.

London, W. C. 2, Charles Griffin & Co. Ltd., 42, Drury Lane. 22nd edition. (Price : 18 sh. net.)

1927 69 (02

BISHOP (Carlton Thomas).

Problems in structural design.

New York. John Wiley & Sons, Inc.; London, Chapman & Hall, Limited. (Price : 10 sh. net.)

1927 691. (02

CHILDE (H. L.).

The manufacture and uses of concrete products and cast stone.

London, S. W. 1, Concrete Publications, Ltd., 20, Darthmouth Street. (Price : 5 sh. net.)

1927 01

COOPER (Isabella M.).

A. L. A. catalog 1926 : an annotated basic list of 10 000 books.

Chicago American Library Association. (8 × 10 inches), 1 295 pages (Price : $6.00.)

1927 385. (02

CORDEAL (Ernest).

Railroad operation. Outlines principles of management. New York, N. Y., 30, Church Street; London S. W. 1, 34, Victoria Street, Simmons-Boardman Publishing Co. (5 × 7 3/4 inches). 255 pages. (Price : $ 1.50).

1927 721 .9 (02

CRANE (Theodore), C. E.

Concrete building construction.

New York, John Wiley & Sons, Inc.; London, Chapman & Hall, Ltd. (6 × 9 inches), 689 pages, many half-tones and line cuts, tables, bibliography. (Price : $6.00.)

1927 691

FABER (Oscar), D. Sc.

Constructional steelwork simply explained.

London, Humphrey Milford. (Price : 6 sh. net.)

1927 389. (02 (.73)

Federal and State laws relating to weights and measures.

Washington D. C., published by U. S. Government Printing Office : 3rd edition, revised by William Parry, 976 pages. (Price $2.30.)

1927 656 .222.1 (09.3 (.42)

The « Flying Scotsman ».

London N. 1, issued by the London & North Eastern Railway, King's Cross Station. 2nd edition. (Price : 1 sh.)

1927 625 .2 (02

HARTOUGH (E. W.).

Car inspector's handbook.

New York, N. Y., 30, Church Street; London S. W. 1, 34, Victoria Street. Simmons-Boardman Publishing Co. 271 pages, 69 illust. (Price : $2.50.)

1927 625 .26 (02

HARTOUGH (E. W.).

Handbook of steel car repairs.

New York, N. Y., 30, Church Street; London S. W. 1., 34, Victoria Street. Simmons-Boardman Publishing Co., 270 pages, 180 illust. (Price : $2.50.)

1927 744

HEARN (Sir Gordon), Col., C. I. E., D. S. O., Assoc. Inst. C. E.

Preparation of plans for railways.

Calcutta, Thacker, Spink & Co.; London E. C. 4, W. Thacker & Co., 2, Creed Lane. (13 3/4 × 8 3/4 inches), 20 pages and plans. (Price : 10 Rupees.)

1927 313 .385. (02

KIRKUS (A. E.), O. B. E., M. Inst. T., director of statistics, Ministry of Transport of Great Britain.

Railway Statistics. Their compilation and use.

London, W. C. 2, Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway. (5 1/2 × 8 5/8 inches), 134 pages, tables & fig. (Price : 5 sh. net.)

1927 621 .165. (02

LASCHE (O.).

Materials and design in turbo-generator plant. Third enlarged and re-written edition by Walter Kieser. English edition by Mellanby (professor A. L.), D. Sc., and Roylands Cooper (W.).

Edimburgh and London, Oliver & Boyd. (Price : 24 sh. net.)

1927 721. (02

LE CORBUSIER.

Towards a new architecture.

London, E. C. 4, John Rodker, 1, Farringdon Avenue. (Price : 25 sh. net.)

1927 385 .1 (.54)

LINES (A.), F. C. H., M. I. E., (Ind.), director, civil engineering, Railway Board.

The estimation of passenger earnings on new projects.

Calcutta. Government of India Central Publication Branch. Technical paper No. 259. 13 pages and a map. (Price : Annas 9 or 1 sh.)

1927 625 .235. (02 & 625 .246. (02

MILLER (B. E.).

Painting of railway equipment.

New-York, N. Y., 30, Church Street; London S. W. 1; 34, Victoria Street. (5 × 7 3/4 inches), 127 pages. Price: $1.50.)

1927 51 (08

MOLLIER (R.), Dr.

The Mollier steam tables and diagrams.

London, W. C. 2, Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway. (Price : 7 sh. 6 d. net.)

1927 313 .385 (.66) & 385. (08 (.66)

NIGERIAN RAILWAY AND UDI COAL MINES.

Administrative report for the year ending 31st March 1927. (With appendices.)

Ebute Metta, Printed by the Superintendent of Press. 88 pages, tables, fig. and a map.

1927 621 .31

OLLIVER (C. W.), B. Sc., E. S. E. (Paris).

The A. C. commutator motor.

London, W. C. 2, Chapman & Hall, Limited, 11, Henrietta Street. (10 × 6 × 1 1/4 inches.), 281 pages. (Price : 21 sh. net.)

1927 621 .132.8 & 656 .27

Some railway problems of to day and their solution.

London, S. W. 1, published by the Railway Department of Sentinel Wagon Works Limited, 20, Iddesleigh House, Westminster.

1927 621 .34

TAYLOR (William T.).

Overhead electric power transmission engineering.

London, Charles Griffin & Company, Limited. (Price : 35 sh. net.)

1927 625 .13 (.73).
The contractor's story of the **Moffat tunnel.**
Denver, Colo. and New York, Hitchcock & Tinkler, Inc. contractors. 59 pages profusely illustrated and semi-technical description.

1927 621. (02
UNWIN (professor W. Cawthorne), F. R. S. & **MELLANBY** (professor A. L.), D. Sc.
The elements of machine design. Part. 1.
London, Longmans, Green & Company, Limited. (Price : 15 sh. net.)

1927 614. (02
WOODBURY (Robert Morse).
Worker's health and safety : a statistical program.
New York, The Macmillan Co. (5 × 8 inches), 207 pages. (Price : $2.50.)

In Italian.

1927 621 .116. (02 & 621 .133.1 (02
BONCINELLI (L.), ingeniere.
Combustione e combustibili. Vol. II.
Milano, Ulrico Hoepli. (Prezzo : 88 lire.)

1927 621 .31 (02
MINISTERO DEI LAVORI PUBBLICI. Servizio idrografico.
La produzione di **energia elettrica** in Italia nel 1926.
Roma, Provveditorato dello Stato-Libreria. (Prezzo : Lire 10.)

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II. — PERIODICALS.

In French.

Annales des Ponts et Chaussées. (Paris.)

1927 628 .111 (.45)
Ann. des ponts et chauss., part. tech., mai-juin, p. 233.
SENTENAC. — Notice sur les **captages d'eaux souterraines** dans les alluvions de l'Arno à Florence. (9 300 mots, 9 tableaux & fig.)

1927 624 .2
Ann. des ponts et chauss., part. tech., juill.-août, p. 45.
COINTE. — Sur une méthode de calcul des **poutres continues.** (2 000 mots & fig.)

Annales des travaux publics de Belgique. (Bruxelles.)

1927 624 .63 (.493)
Ann. des travaux publics de Belgique, octobre, p. 657.
CLAEYS (E.) & YON (Ch.). — Le **nouveau pont en béton armé** construit sur la Meuse à Heer-Agimont. (9 300 mots, tableaux & fig.)

Arts et Métiers. (Paris.)

1927 669 .1 & 625 .212
Arts et Métiers, août, p. 289.
VOSGIEN (H. G.). — De l'influence de la teneur moyenne en manganèse des charges des fours et de la teneur en silicium du métal fini sur la **fabrication des bandages de roues.** (2 600 mots, 2 tableaux & fig.)

1927 621 .116 & 691
Arts et Métiers, août, p. 301.
BOUCHARD. — **Protection des tubes de condenseurs et des surfaces métalliques** en contact avec l'eau. (800 mots, 1 tableau & fig.)

1927 621 .133.7
Arts et Métiers, septembre, p. 326.
LANGUMIER (A.). — **Epuration chimique des eaux industrielles** par précipitation. (7 700 mots & fig.)

1927 625 .141
Arts et Métiers, septembre, p. 342.
VANIEU (J.). — **Le ballast.** (14 500 mots & fig.)

Bulletin de la Société des ingénieurs civils de France. (Paris.)

1927 621 .31 (.44)
Bull. de la Soc. des ing. civils de France, mai, p. 645.
MAROGER (J.). — L'utilisation des grands réseaux de transport. (8 800 mots, 1 tableau & fig.)

1927 621 .2 (.09.3 (.44)
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Séance solennelle du samedi 11 juin 1927 pour commémorer le centième anniversaire de la réalisation industrielle de la turbine par Benoît Fourneyron. (17 000 mots & fig.)

Bulletin technique de la Suisse romande. (Vevey.)

1927 385 .2
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JACQUINOT. — Comparaisons entre les **prix de transport par chemins de fer et par voies navigables.** (1 300 mots.)

Chronique des transports. (Paris.)

1927 385 .14 (.45)
Chronique des transports, n° 17, 10 septembre, p. 4.
Les premiers effets de la revalorisation de la lire en ce qui concerne les chemins de fer. (1 200 mots.)

1927 385 .14 (.44)
Chronique des transports, n° 17, 10 septembre, p. 7.
BLOCH (R.). — Les tarifs de chemins de fer et la cherté de la vie. (2 600 mots.)

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Chronique des transports, n° 18, 25 septembre, p. 3.
La journée de huit heures dans les chemins de fer. (1 200 mots.)

Génie civil. (Paris.)

1927 624 .63 (.61)
Génie civil, n° 2353, 17 septembre, p. 275.
DANTIN (C.). — Pont en béton armé de 92 mètres de portée sur l'oued Mellègue (Tunisie). (2 000 mots & fig.)

1927 721 .9 (.460)
Génie civil, n° 2354, 24 septembre, p. 304.
RIBERA (J. E.). — Caissons en béton armé, avec fond, pour divers travaux maritimes, exécutés en Espagne. (1 600 mots & fig.)

1927 625 .143.3
Génie civil, n° 2355, 1er octobre, p. 327.
FREMONT (Ch.). — Contribution à l'étude de l'usure ondulatoire des rails. (2 200 mots & fig.)

1927 721 .1 & 721 .9
Génie civil, n° 2355, 1er octobre, p. 334.
Les fondations sur pieux en béton armé avec base élargie par explosion ou par refoulement. (1 000 mots & fig.)

1927 624 .52 (.44)
Génie civil, n° 2356, 8 octobre, p. 341.
LEINEKUGEL LE COCQ (G.). — Pont suspendu rigide de Montjean, sur la Loire, avec fermes en arc à trois articulations. (3 800 mots, 1 tableau & fig.)

Les chemins de fer et les tramways. (Paris.)

1927 621 .132.3 (.44)
Les ch. de fer et les tramw., septembre, p. 170.
Les locomotives « Super-Pacific » du Chemin de fer du Nord en exploitation. (850 mots & fig.)

1927 625 .156
Les ch. de fer et les tramw., septembre, p. 172.
Butoir-frein pour chemins de fer. (450 mots & fig.)

1927 621 .132.8
Les ch. de fer et les tramw., septembre, p. 173.
Locomotive à vapeur à piston et turbine à condensation sur tender moteur. (700 mots & fig.)

1927 621 .134.3
Les ch. de fer et les tramw., septembre, p. 174.
Note sur la fabrication des collecteurs de vapeur surchauffée pour locomotives. (1 400 mots & fig.)

1927 625 .251
Les ch. de fer et les tramw., septembre, p. 177.
BOURGAIN (A.). — Le freinage continu des trains de marchandises. (5 700 mots, 1 tableau & fig.)

Revue universelle des mines, de la métallurgie, des travaux publics, des sciences et des arts appliqués à l'industrie. (Liége.)

1927 721 .5 (01
Revue universelle des mines, n° 1, 1er octobre, p. 6.
LEMAIRE (L.). — Etude des fermes de toitures reposant sur des colonnes métalliques. (1 600 mots, 1 tableau & fig.)

1927 625 .251 (.43)
Revue universelle des mines, n° 2, 15 octobre, p. 66.
MAGNÉE (P.). — Notes relatives à un mémoire sur les dépenses et les résultats économiques de l'application du Kunze Knorr « G » comme frein continu pour trains de marchandises. (1 200 mots & 3 tableaux.)

In German.

Elektrische Bahnen. (Charlottenburg.)

1927 621 .335
Elektrische Bahnen, 15. September, S. 259.
REICHEL (W.) und KOPCZYNSKI (Th.). — Elektrische Güterzug-Umformerlokomotive, Bauart Ford. (3 000 Wörter u. Abb.)

1927 621 .332 (.4) & 656 .254 (.4)
Elektrische Bahnen, 15. September, S. 266.
EGGELING (G.). — Die europäischen « Richtlinien » zum Schutz von Fernsprechtleitungen gegen die Beeinflussung durch elektrische Bahnen. (1 900 Wörter.)

1927 621 .332 & 62. (08
Elektrische Bahnen, 15. September, S. 271.
SÜBERKRÜB (M.). — Berechnung von Mastfundamenten mit Tabellen und Kurven. (1 000 Wörter, 1 Tabelle u. Abb.)

1927 621 .336 (.431)
Elektrische Bahnen, 15. September, S. 277.
BOSSELMANN (R.). — Ueber die Verwendung von Akkumulatoren für elektrischbetriebene Stadt- und Vorortbahnen. (2 100 Wörter, 1 Tabelle u. Abb.)

Glasers Annalen. (Berlin.)

1927 697 (.47) & 725 .4 (.47)
Glasers Annalen, Heft 5, 1. September, S. 75.
RUNKEL. — Der wärmewirtschaftliche Ausbau der Muromer Eisenbahn-Werkstätten (Moskau-Kasaner Eisenbahn). (2 800 Wörter u. Abb.)

1927 621 .132
Glasers Annalen, Heft, 5, 1. September, S. 78.
THEOBALD. — **Die Lokomotivbezeichnungen** verschiedener Länder. (1 300 Wörter u. 2 Tabellen.)

1927 625 .2 (.43)
Glasers Annalen, Heft 5, 1. September, S. 82.
PRZYGODE. — **Der Bau der Einheitswagen** der Deutschen Reichsbahn-Gesellschaft. (1 100 Wörter.)

1927 621 .3 & 656 .224
Glasers Annalen, Heft 6, 15. September, S. 91.
SCHWAIGHOFER (H.). — **Elektroposten**, unter besonderer Berücksichtigung der bei neueren Mechanisierungen des Postbetriebes gewählten Konstruktionen. (3 000 Wörter u. Abb.)

In English.

Bulletin, American Railway Engineering Association. (Chicago.)

1927 656 .284 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, July, p. 1.
The **Mississippi Valley flood-1927.** (29 000 words, tables & fig.)

Electric Railway Journal. (New York.)

1927 388 (.73)
Electric Railway Journal, No. 11, September 10, p. 423.
Transportation survey made in Newark. (1 900 words & fig.)

1927 388 (.73)
Electric Railway Journal, No. 11, September 10, p. 425.
HAWKINS (C. L.). — **Rapid track reconstruction** in St. Louis. (1 000 words & fig.)

1927 388 (.73) & 625 .1 (.73)
Electric Railway Journal, No. 11, September 10, p. 428.
First station completed on **Dorchester Rapid Transit.** (300 words & fig.)

1927 385 .4 (.44) & 621 .33 (.44)
Electric Railway Journal, No. 11, September 10, p. 429.
How the **duties** are assigned abroad. (1 400 words & fig.)

1927 385 .575 (.73)
Electric Railway Journal, No. 11, September 10, p. 431.
Quality trainmen obtained for the transportation department (2 700 words & fig.)

1927 625 .216 (.43)
Electric Railway Journal, No. 11, September 10, p. 435.
Hamburg Elevated develops **automatic combination coupler.** (500 words & fig.)

1927 51 (01
Electric Railway Journal, No. 11, September 10, p. 436.
ROBERTS (E. A.). — **Calculating rail tonnages by a lightning method.** (600 words.)

1927 621 .33 (.73)
Electric Railway Journal, No. 12, September 17, p. 470.
McWHORTER (A. D.). — **Modern light-weight cars.** (1 600 words & fig.)

1927 621 .33 (.73)
Electric Railway Journal, No. 12, September 17, p. 473.
LOCKWOOD (R. J.). — Heavy traffic in major cities demands **large double-truck cars.** (1 800 words & fig.)

1927 621 .33 (.73)
Electric Railway Journal, No. 12, September, 17, p. 477.
DANA (E.). — Congestion demands use of **surface line trains** for economy. (3 900 words & fig.)

1927 621 .33 (.73)
Electric Railway Journal, No. 12, September 17, p. 482.
EMMONS (S. E.). — **Articulated units** are useful for mass transportation. (2 200 words & fig.)

1927 388 (.73)
Electric Railway Journal, No. 12, September 17, p. 485.
McILRAITH (E. J.). — Determining the relation of **rapid transit** in a transportation plan. (2 300 words & fig.)

1927 621 .33 (.73)
Electric Railway Journal, No. 12, September 17, p. 489.
BIGELOW (H.). — **Single-truck cars** best meet the needs in smaller communities. (2 500 words & fig.)

1927 621 .33 (.73)
Electric Railway Journal, No. 12, September 17, p. 499.
BROWN (H. F.). — **Electrification** of railroads makes for high-grade suburban service. (3 500 words & fig.)

1927 656 (.4)
Electric Railway Journal, No. 12, September 17, p. 528.
BLAKE (H. W.). — Meeting the demands for **better transportation** in Europe. (3 200 words & fig.)

1927 388 (.73)
Electric Railway Journal, No. 13, September 24, p. 542.
Co-ordination essential for **rapid transit** in Cincinnati. (4 300 words & fig.)

1927 388 (.431) & 621 .33 (.431)
Electric Railway Journal, No. 13, September 24, p. 549.
BLAKE (H. W.). — **Berlin practices co-ordination in transportation.** (2 900 words, 3 tables & fig.)

1927 625 .151 (.73)
Electric Railway Journal, No. 13, September 24, p. 555.
Standard tongue switch designed. (700 words & fig.)

1927 385 .585 (.73)
Electric Railway Journal, No. 14, October 1, p. 582.
12 000 employees can use this **library.** (2 200 words & fig.)

1927 388 (.4) & 621 .338 (.4)
Electric Railway Journal, No. 14, October 1, p. 587.
BLAKE (H. W.). — **Rapid transit** car design and noise reduction in Europe. (2 600 words, 1 table & fig.)

1927 621 .338 (.73)
Electric Railway Journal, No. 14, October 1, p. 599.
Springfield and Worcester Companies introduce latest light-weight city-type car. (1 900 words, 1 table & fig.)

Engineer. (London.)

1927 656 .281 (.42)
Engineer, No. 3740, September 16, p. 312.
The Sevenoaks derailment. (1 200 words & fig.)

1927 621 .116 (.42)
Engineer, No. 3740, September 16, p. 320.
Wrought steel steam valves. (700 words & fig.)

1927 624. (01 (.42)
Engineer, No. 3741, September 23, p. 346.
Strengthening a bridge over the River Don. (2 300 words & fig.)

1927 669 .1
Engineer, No. 3741, September 23, p. 347.
Iron and Steel Institute. (5 300 words.)

1927 656 .211.7 (.42)
Engineer, No. 3741, September 23, p. 351.
Flettner rudder equipment on the new Wallasey ferry boats. (1 300 words & fig.)

1927 385. (01 (.51)
Engineer, No. 3741, September 23, p. 352.
Railway communications in China. (900 words.)

1927 621 .335 (.73)
Engineer, No. 3742, September 30, p. 366.
Electric locomotives for the American Great Northern Railway. (1 100 words & fig.)

1927 62. (01 & 669 .1
Engineer, No. 3742, September 30, p. 371.
Hardness and superhardness. (1 700 words.)

1927 621 .116. (01
Engineer, No. 3742, September 30, p. 372.
The pulverisation of coal. (1 500 words.)

Engineering. (London.)

1927 669 .1 (.42)
Engineering, No. 3219, September 23, p. 400.
The Iron and Steel Institute. (3 100 words.)

1927 669 .1
Engineering, No. 3219, September 23, p. 409.
ROSENHAIN (W.) & HANSON (D.). — The behaviour of mild steel under prolonged stress at 300 deg. C. (1 500 words & 2 tables.)

1927 621 .165
Engineering, No. 3220, September 30, p. 411.
10 000-14 000 kw. Ljungström steam turbine. (3 200 words & fig.)

1927 62. (01
Engineering, No. 3220, September 30, p. 417.
An adjustable dash pot for cement testing. (750 words & fig.)

1927 62. (01 & 669 .1
Engineering, No. 3220, September 30, p. 420.
The superhardening of hard steel. (1 300 words & fig.)

1927 621 .165 (.42)
Engineering, No. 3220, September 30, p. 422.
The Roth steam turbine. (850 words & fig.)

1927 621 .82 (.42)
Engineering, No. 3220, September 30, p. 423.
A friction-drive variable speed gear. (1 000 words & fig.)

Engineering News-Record. (New York.)

1927 625 .13 (.944)
Engineering News-Record, No. 10, September 8, p. 381.
Tunneling for city railway at Sydney, Australia. (800 words & fig.)

1927 62. (01 & 721 .1
Engineering News-Record, No. 10, September 8, p. 396.
WEISKOPF (W. H.). — Details for wind connections in tier buildings. (2 000 words & fig.)

1927 625 .13 (.73)
Engineering News-Record, No. 10, September 8, p. 400.
Repair buckled posts in swing span. (500 words & fig.)

1927 721 .9 (01
Engineering News-Record, No. 10, September 8, p. 402.
DURST (R. C.). — Method for testing bond between concrete and its reinforcing. (200 words & fig.)

1927 625 .122 (.73)
Engineering News-Record, No. 10, September 8, p. 403.
Blasting railroad cuts. (500 words & fig.)

1927 721 .1 (.73)
Engineering News-Record, No. 11, September 15, p. 424.
DICKINSON (C. H.). — Foundation work hampered by soft ground and seamy rock. (1 300 words & fig.)

1927 624 .32 (.73)
Engineering News-Record, No. 11, September 15, p. 426.
JOHNSON (C.). — Missouri River highway bridges in North Dakota. (2 400 words & fig.)

1927 625 .245 (.73)
Engineering News-Record, No. 11, September 15, p. 428.
Railway track-recording car uses gyroscope. (1 700 words & fig.)

1927 656 .1 (.73) & 656 .2 (73)
Engineering News-Record, No. 11, September 15, p. 436.
WILLIAMS (M. W.). — N. Y. canal terminals designed for rapid cargo handling. (2 200 words & fig.)

Great Western Railway Magazine. (London.)

1927 624 .61 (.42)
Great Western Ry. Magazine, October, p. 397.
Replacement of timber viaducts on the Falmouth branch. (800 words & fig.)

Locomotive Railway Carriage & Wagon Review. (London.)

1927 621 .134.3 (.42)
Loc. Ry. Carriage & Wagon Review, Sept. 15, p. 273.
Express passenger locomotive with poppet valves, L. & N. E. Railway. (900 words & fig.)

1927 621 .132.3 (.42)
Loc. Ry. Carriage & Wagon Review, Sept. 15, p. 275.
Four-cylinder express engine, Lord Nelson class, Southern Railway. (600 words & fig.)

1927 621 .132 (.460)
Loc. Ry. Carriage & Wagon Review, Sept. 15, p. 276.
Recent Spanish-built locomotives. (350 words, 1 table & fig.)

1927 621 .335 (.44)
Loc. Ry. Carriage & Wagon Review, Sept. 15, p. 278.
High speed electric locomotive, C. de f. du Midi. (2 000 words & fig.)

1927 385. (09.1 (.51)
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The present position of the **Chinese Government Railways**. (2 100 words.)

1927 621 .13 (09.3 (.44)
Loc. Ry. Carriage & Wagon Review, Sept. 15, p. 302.
St. Etienne-Lyon Railway. Marc Seguin's multitubular locomotive boilers. (700 words & fig.)

Modern Transport. (London.)

1927 385. (09.1 (.66)
Modern Transport, No. 444, September 17, p. 3.
Progress on **Nigerian Railways.** (1 800 words & fig.)

1927 656 .25 (01
Modern Transport, No. 445, September 24, p. 2.
Economies from **signalling.** (2 000 words.)

1927 385. (01
Modern Transport, No. 445, September 24, p. 3.
SHERRINGTON (C. E. R.). — **Railway problems** at home and abroad. (2 000 words.)

1927 656 .1 (.73) & 656 .2 (.73)
Modern Transport, No. 445, September 24, p. 6.
Railways and road transport. Economic spheres. (700 words.)

1927 313 .385. (0
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Railway statistics. Their use and abuse. (1 30 words.)

1927 656 .1 & 656 .
Modern Transport, No. 445, September 24, p. 17.
Railways and road carrying powers. (1 500 words.).

1927 656 .23 (0
Modern Transport, No. 446, October 1, p. 2.
Railways and the traders. (900 words.)

1927 656 .222.1 (.42
Modern Transport, No. 446, October 1, p. 3.
Longest non-stop run in the world. (2 300 words & fig.)

1927 656 .235.4 (.42
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Railway rates revision. (1 200 words.)

Proceedings, American Railway Association. (Signal Section.) (New York.)

1927 656 .25 (.73
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Committee X—**Signaling practice.** (7 500 words & fig.)

1927 656 .25 (01 (.73
Proceed. Amer. Ry. Ass^{on}, Signal Section, August, p. 46
Committee I—Economics of **railway signaling** (80 words.)

1927 656 .26 (01 (.73
Proceed. Amer. Ry. Ass^{on}, Signal Section, August, p. 50
Committee V—**Instructions.** (12 000 words, 2 table & fig.)

1927 656 .254 (.73
Proceed. Amer. Ry. Ass^{on} Signal Section, August, p. 103
Special Committee—**Highway crossing protection** (2 700 words.)

1927 656 .256.3 (.73
Proceed. Amer. Ry. Ass^{on}, Signal Section, August, p. 110
Committee IV—Direct current **automatic block signaling.** (4 800 words.)

1927 656 .257 (.73
Proceed. Amer. Ry. Ass^{on}, Signal Section, August, p. 144
Committee II—**Mechanical interlocking.** (6 500 words.)

1927 656 .25 (01 (.73
Proceed. Amer. Ry. Ass^{on}, Signal Section, August, p. 171
Committee VI—**Designs.** (300 words & fig.)

1927 656 .257 (.73
Proceed. Amer. Ry. Ass^{on}, Signal Section, August, p. 187
Committee III—**Power interlocking.** (16 000 words & fig.)

Proceedings, Institution of Mechanical Engineers. (London.)

1927 621 .114. (01
Proceed. Institut. of Mechan. Engineers, No. 2, p. 291.
ORMANDY (W. R.). — **Lubrication.** (14 000 words & fig.)

1927 621 .132.8 (.42) & 621 .4 (.42)
Proceed. Institut. of Mechan. Engineers, No. 2, p. 333.
CLARK (E. K.). — **An internal-combustion locomotive.** (23 000 words & fig.)

1927 62. (01 & 669 .1
Proceed. Institut. of Mechan. Engineers, No. 2, p. 403.
LEA (F. C.) & HEYWOOD (F.). — **The failure of some steel wires under repeated torsional stresses at various mean stresses determined from experiments on helical springs.** (19 500 words, 4 tables & fig.)

1927 621 .134.1
Proceed. Institut. of Mechan. Engineers, No. 2, p. 465.
DIAMOND (E. L.). — **An investigation into the cylinder losses in a compound locomotive.** (20 000 words, 2 tables & fig.)

1927 621 .4 (01
Proceed. Institut. of Mechan. Engineers, No. 2, p. 519.
ALLCUT (E. A.). — **Further tests on a two-stroke cycle oil-engine.** (3 400 words, 6 tables & fig.)

1927 621 .116. (01
Proceed. Institut. of Mechan. Engineers, No. 2, p. 549.
POTTER (R. B.). — **Pulverized fuel and its application to boilers.** (2 400 words.)

1927 621 .165. (01
Proceed. Institut. of Mechan. Engineers, No. 2, p. 555.
ARROWSMITH (G.). — **The small steam-turbine unit for industrial requirements.** (3 800 words, 2 tables & fig.)

1927 621 .39 & 621 .8
Proceed. Institut. of Mechan. Engineers, No. 2, p, 567.
WALTERS (J. P.). — **The mechanical equipment of electric lifts.** (4 700 words.)

Railway Age. (New York.)

1927 385 .14 (.73)
Railway Age, No. 10, September 3, p. 432.
Freight rates and prices for thirty-seven years. (1 900 words & fig.)

1927 621 .132.5 (.73)
Railway Age, No. 10, September 3, p. 435.
Ten 2-8-8-2 type locomotives for the D. & R. G. W. (1 300 words, 1 table & fig.)

1927 656 .211 (.73) & 725 .31 (.73)
Railway Age, No. 10, September 3, p. 439.
Southern builds new passenger station at Greensboro, N. C. (4 300 words & fig.)

1927 625 .232 (.73)
Railway Age, No. 10, September 3, p. 449.
C. & N. W. roller bearing suburban coaches on exhibition. (1 400 words & fig.)

1927 625 .143.1 (.73)
Railway Age, No. 11, September 10, p. 473.
WRENSHALL (J. C.). — **Reading tests new rail section.** (1 300 words & fig.)

1927 613 .3 (.73)
Railway Age, No. 11, September 10, p. 475.
Joint Committee presents report on drinking water. (2 300 words & fig.)

1927 656 .221. (01
Railway Age, No. 11, September 10, p. 477.
SCHMIDT (E. C.). — **Freight train curve resistance.** (900 words, 1 table & fig.)

1927 621 .132.3 (.73)
Railway Age, No. 11, September 10, p. 478.
4-8-2 type locomotive for the Central Vermont. (450 words, 1 table & fig.)

1927 656 .237 (.73)
Railway Age, No. 11, September 10, p. 479.
PARKS (C. E.). — **Cost accounting and the operating expense classification.** (4 500 words.)

1927 621 .133.8 (.73)
Railway Age, No. 11, September 10, p. 485.
Vacuum type bell ringer on market. (200 words & fig.)

1927 656 .284 (.73)
Railway Age, No. 12, September 17, p. 511.
What the flood did to the railways. (4 900 words & fig.)

1927 385. (09 (.73)
Railway Age, No. 12, September 17, p. 516.
Great Northern expects big year. (2 900 words, 2 tables & fig.)

1927 625 .235. (06 (.73)
Railway Age, No. 12, September 17, p. 520.
Master painters meet at Louisville. (850 words.)

1927 656 .25 (06 (.73)
Railway Age, No. 12, September 17, p. 521.
Signal section meets in Montreal. (4 700 words.)

1927 656 .24 (04 (.73)
Railway Age, No. 12, September 17, p. 525.
Claim prevention conference. (3 000 words.)

1927 656 .211.7 (01
Railway Age, No. 12, September 17, p. 527.
Should the railways operate ships? (1 500 words.)

1927 621 .139 (.71 + .73) & 625 .27 (.71 + .73)
Railway Age, No. 12, September 17, p. 529.
Shop and car foremen discuss supply problems. (2 200 words & fig.)

1927 656 .223.2 (.73) & 625 .26 (.73)
Railway Age, No. 12, September 17, p. 531.
DEMAREST (T. W.). — **Terminal delays to freight cars.** (3 000 words.)

1927 385 .1 (.73) & 385 .3 (.73)
Railway Age, No. 12, September 17, p. 533.
Recent developments in **railroad valuation.** (3 500 words.)

1927 621 .13 (06 (.73)
Railway Age, No. 12, September 17, p. 536.
J. E. Taussig praises work of traveling engineers. (2 500 words.)

Railway Engineer. (London.)

1927 621 .135. (01
Railway Engineer, October, p. 354.
Tank engines and high speeds. (1 000 words.)

1927 51 & 656 .22
Railway Engineer, October, p. 357.
Out-of-gauge loads. (1 100 words, tables & fig.)

1927 625 .1 (.42)
Railway Engineer, October, p. 362.
Further engineering developments, Southern Railway. (800 words & fig.)

1927 625 .14 (.945)
Railway Engineer, October, p. 365.
Track relaying in Victoria. (300 words & fig.)

1927 625 .142.3 (.73)
Railway Engineer, October, p. 365.
Old rails used as **sleepers.** (150 words & fig.)

1927 621 .132.5 (.66)
Railway Engineer, October, p. 369.
New 2-8-2 type locomotives for Kenya & Uganda Railway. (700 words & fig.)

1927 621 .132.6 (.43)
Railway Engineer, October, p. 371.
New Mallet tank locomotive for the German Railways. (600 words & fig.)

1927 621 .135.2 (.42) & 625 .214 (.42)
Railway Engineer, October, p. 373.
The production of **R. C. H. axle brasses.** (3 400 words & fig.)

1927 625 .245 (.83)
Railway Engineer, October, p. 377.
Heavy loads on a narrow-gauge line. (350 words & fig.)

1927 621 .132.8 (.42 + .62)
Railway Engineer, October, p. 379.
The development of the **steam rail motor car.** (2 400 words & fig.)

Railway Engineering & Maintenance. (Chicago.)

1927 625 .141. (01
Railway Engineering and Maintenance, Sept., p. 356.
Is a **ballast toe** line worth while. (7 200 words & fig.)

1927 625 .13 (73)
Railway Engineering and Maintenance, Sept. p. 364.
Central Vermont carries out complex **bridge renewal work.** (2 700 words & fig.)

1927 625 .143.1 (.73) & 625 .143.4 (.73)
Railway Engineering and Maintenance, Sept., p. 369.
WRENSHALL (J. C.). — The Reading adopts a **new rail section.** (1 600 words & fig.)

1927 625 .161 (.73) & 721 .9 (.73)
Railway Engineering and Maintenance, Sept., p. 373.
Erie builds **tool houses of concrete.** (2 000 words & fig.)

1927 625 .172 (.73)
Railway Engineering and Maintenance, Sept., p. 376.
SOLLARS (J. A.). — **Keep the track bolts tight.** (800 words.)

1927 625 .245 (.73)
Railway Engineering and Maintenance, Sept., p. 381.
A new Koppel **dump car.** (900 words & fig.)

1927 625 .16 (.73)
Railway Engineering and Maintenance, Oct., p. 398.
Can a road afford to spend money for **improved appearances?** (2 200 words & fig.)

1927 625 .151 (01
Railway Engineering and Maintenance, Oct., p. 401.
The why and how of **guard rails.** (1 500 words & fig.)

1927 656 .284 (.73)
Railway Engineering and Maintenance, Oct., p. 402.
ARMSTRONG (W. R.). — **A western flood in action.** (1 200 words.)

1927 625 .19 (.73) & 691 (.73)
Railway Engineering and Maintenance, Oct., p. 404.
Is the **control of brine drippings** an impossible task? (3 700 words & fig.)

1927 624 .7 (.73)
Railway Engineering and Maintenance, October, p. 408.
Forty bridge spans erected in four days. (2 100 words & fig.)

1927 621 .14 (06 (.73)
Railway Engineering and Maintenance, October, p. 411.
Roadmasters meet at Buffalo, N. Y. (30 000 words & fig.)

Railway Gazette & Railway News. (London.)

1927 625 .232 (.42)
Railway Gazette & News, No. 12, September 16, p. 337.
New first-class corridor coaches, London Midland & Scottish Railway. (350 words & fig.)

1927 625 .232 (.68)
Railway Gazette & News, No. 12, September 16, p. 340.
Double-deck passenger carriage, South African Railways. (800 words & fig.)

1927 385 .586 (.42)
Railway Gazette & News, No. 13, September 23, p. 362.
Apprentices in railway shops. (700 words.)

1927 621 .85 (.82)
Railway Gazette & News, No. 13, September 23, p. 364.
White-metalling plant for the Central Argentine Railway. (600 words & fig.)

1927 656 .253 (.41)
Railway Gazette & News, No. 13, September 23, p. 366.
Colour light signalling at York Road Station, Belfast. (1 500 words & fig.)

1927 385 .586 (.73)
Railway Gazette & News, No. 13, September 23, p. 370.
STEAD (A. L.). — **Apprentice training** on the New York Central Lines. (1 500 words, 2 tables & fig.)

1927 656 .222.1 (.42)
Railway Gazette & News, No. 14, Sept. 30, p. 397.
Record non-stop schedules on the L. M. S. R. (1 400 words & fig.)

1927 621 .13 (06 (.42)
Railway Gazette & News, No. 15, October 7, p. 423.
Institution of **locomotive engineers**. (2 800 words.)

1927 385 .113 (.45)
Railway Gazette & News, No. 15, October 7, p. 425.
Italian Railways in 1925-1926. (1 000 words.)

1927 385 .51 (.42)
Railway Gazette & News, No. 15, October 7, p. 426.
New scheme of nogotiating machinery for **railway shop staff**. (2 200 words.)

1927 621 .135. (01
Railway Gazette & News, No. 15, October 7, p. 428.
Tank locomotives and derailments. (1 000 words & fig.)

1927 385. (07.4 (.42)
Railway Gazette & News, No. 15, October 7, p. 433.
L. N. E. R. railway museum at York. (500 words & fig.)

Railway Magazine. (London.)

1927 656 .211.4 (.44)
Railway Magazine ,October, p. 257.
GLYNN (L. A.). — **The Gare de Lyon (Paris) terminus** of the Paris, Lyons and Mediterranean Railway. (4 600 words & fig.)

1927 385. (09.1 (.42)
Railway Magazine, October, p. 269.
PERKINS (T. R.). — **Railways in the Severn Valley.** (3 900 words & fig.)

1927 625 .61 (09.1 (.42)
Railway Magazine, October, p. 285.
The **Romney, Hythe and Dymchurch Railway.** (2 000 words & fig.)

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Railway Magazine, October, p. 292.
ALLEN (C. J.). — **British locomotive practice and performance.** (3 400 words, 3 tables & fig.)

Railway Mechanical Engineer. (New York.)

1927 621 .134.3 (01
Railway Mechanical Engineer, September, p. 582.
TAGGART (J. M.). — **High pressure steam locomotives.** (3 700 words, 2 tables & fig.)

1927 621 .134.5 (.73)
Railway Mechanical Engineer, September, p. 585.
Grease cup filling device. (200 words & fig.)

1927 621 .132.7 (.73)
Railway Mechanical Engineer, September, p. 589.
Three-cylinder **0-8-0 type switchers.** (1 000 words, 1 table & fig.)

1927 621 .86 (.73) & 625 .26 (.73)
Railway Mechanical Engineer, September, p. 597.
Passenger truck work facilitated. (2 000 words & fig.)

1927 625 .245 (.73)
Railway Mechanical Engineer, September, p. 602.
Two-way side hinged **dump car.** (1 100 words & fig.)

1927 621 .138.5 (.73)
Railway Mechanical Engineer, September, p. 613.
PERT (A. J.). — Handling the **shoe and wedge job.** (3 800 words & fig.)

1927 621 .133.4 (.73)
Railway Mechanical Engineer, September, p. 629.
Front end throttle valve located to reduce weight. (200 words & fig.)

Railway Signaling. (Chicago.)

1927 656 .253 (.73)
Railway Signaling, September, p. 323.
What will be the growth of **train control?** (800 words.)

1927 656 .254 (.73)
Railway Signaling, September, p. 325.
SCHWENDT (B. J.). — **N. Y. C. first to install complete train dispatching system.** (7 800 words & fig.)

1927 656 .254 (.73)
Railway Signaling, September, p. 336.
ROBERTS (A. A.). — **Train indication system installed by Brooklyn-Manhattan Transit.** (2 000 words & fig.)

1927 656 .253 (.73)
Railway Signaling, September, p. 339.
FLORENCOURT (F. B.). — **Central of Georgia installs color-light signals.** (900 words & fig.)

1927 656 .254 (.73)
Railway Signaling, September, p. 340.
RAYMER (L. S.). — **P. & L. E. trains call for route by microphone.** (500 words & fig.)

1927 656 .256.3 (01
Railway Signaling, September, p. 341.
WEIGEL (J. B.). — **Influence of bonded rail resistance on track circuit safety.** (2 700 words & fig.)

1927 656 .257 (.73)
Railway Signaling, September, p. 348.
Maintenance of Washington terminal interlocking and signals. (1 200 words & fig.)

University of Illinois Bulletin. (Urbana.)

1927 624 .2 (01 & 721 .9 (01
University of Illinois Bulletin, No. 43, June 21, p. 7.
An investigation of web stresses in reinforced concrete beams. (26 000 words, 13 tables & fig.)

In Spanish.

Gaceta de los Caminos de hierro. (Madrid.)

1927 621 .33 (.485)
Gaceta de los Caminos de hierro, n° 3524, 10 de sept., p. 301.
Electrificacion de la linea de Stokolmo a Goteborg. (1 500 palabras.)

1927 656 .1 (.494) & 656 .2 (.494)
Gaceta de los Caminos de hierro, n° 3525, 20 de sept., p. 313.
Competencia entre el ferrocarril y el automóvil en Suiza. (1 000 palabras.)

Ingenieria y Construcción. (Madrid.)

1927 621 .86 (.460)
Ingenieria y Construcción, septiembre, p. 445.
El cable Dúrcal-Motril. (1 300 palabras & fig.)

1927 656 .253 & 656 .256.3
Ingenieria y Construcción, octubre, p. 483.
ESTELLA (A. L.). — **Las señales luminosas diurnas para block automático.** (4 300 palabras & fig.)

1927 62[illegible]
Ingenieria y Construcción, octubre, p. 496.
FISCHER (A.). — **Aumento de la potencia de los motores Diesel de 4 tiempos por medio de sobrealimentación con turbo-compresores.** (6 200 palabras, 3 cuadros & fig.)

In Italian.

Annali dei lavori pubblici. (Roma.)

1927 624 .61 (.45)
Annali dei lavori pubblici, luglio, p. 597.
MIOZZI (E.). — **Il nuovo ponte sulla Piave a Belluno.** (10 000 parole, 5 tabelle & fig.)

Rivista dei trasporti. (Milano.)

1927 388 (.45)
Rivista dei Trasporti, Agosto, p. 123.
SEMENZA (M.). — **Il piano regolatore dei trasporti della citta di Milano.** (21 000 parole & fig.)

1927 656 .1 & 656 .2
Rivista dei Trasporti, Agosto, p. 139.
MALTESE (S.). — **La concorrenza degli autotrasporti.** (3 900 parole.)

Rivista delle comunicazioni ferroviarie. (Roma.)

1927 656 .235 (.45)
Riv. delle Comunic. ferrov., n° 18, 15 sett., p. 15.
BALDONI (E.). — **Le nuove riduzioni delle tariffe** di trasporto merci. (3 500 parole.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1927 656 .254 (.45)
Rivista tecnica delle ferrovie ital., 15 sett., p. 89.
DONATI (S.). — **Dispatching system e telefono selettivo.** (5 400 parole & fig.)

1927 621 .134
Rivista tecnica delle ferrovie ital., 15 sett., p. 103.
GIANNONE (S.). — **Esperimento su di una valvola speciale di presa vapore per caldaie.** (5 800 parole, tabelle & fig.)

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[016 .385 (02]

I. — BOOKS.

In French.

1927 621 .3 (02

BARDIN (R.), ingénieur-électricien (E. S. M. E.).

Les machines électriques industrielles. Principe, fonctionnement, divers types, montage, pannes.

Paris (6e), Desforges, Girardot & Cie, éditeurs, 27 et 29, quai des Grands-Augustins. In-8°, de 80 pages, avec 65 fig. (Prix: 8 francs.)

1927 669. (02

DE LETTRE (G.), docteur ès sciences.

Protection des métaux contre la corrosion.

Paris (9e), Editions de l'Usine, 15, rue Bleue. 208 pages, avec 39 fig. (Prix : 34 francs.)

1927 625 .14 (01

ESTOURNET (Louis), sous-ingénieur du Service de la voie, Compagnie des Ch. de fer P. L. M.

Etude sur la stabilité de la voie ferrée reposant sur un sol compressible. Déformation de la traverse. Déformation du rail. Passage de la roue sur le joint. Travail dans l'éclisse. Cheminement du rail. Application de la méthode. Exemples numériques.

Paris, impr. P. Dubreuil & A. Laroche, 18, rue Clauzel; Librairie polytechnique Ch. Béranger, Paris, 15, rue des Saints-Pères; Liège, rue des Dominicains, 8. In-8°, 81 pages, avec fig.

1926 621 .392

Formulaire à l'usage des techniciens et praticiens de la **soudure autogène.**

Paris (10e), La soudure autogène française, 29, rue Claude-Vellefaux. In-8° (13 × 21 cm.) de 78 pages.

1927 669 .1

FREMONT (Ch.).

Essai de corrosion des fers et des aciers.

Paris, 71e mémoire des Etudes expérimentales de technologie industrielle. In-4° (27 × 22 cm.) de 177 pages, avec 256 fig.

1927 744. (02

LABALETTE (L.), professeur de l'enseignement technique.

La perspective rapide dans le dessin industriel. Perspectives cavalière, axonométrique et isométrique.

Paris (6e), Librairie Centrale des Sciences, Desforges, Girardot & Cie, 27 et 29, quai des Grands-Augustins. In-4° broché de 102 pages avec 73 fig. (Prix : Paris, 18 francs; France, 19 fr.; Etranger, fr. 20.50.)

1926 621 .392

LEBRUN (Maurice).

Applications de la soudure autogène. Chaudières et réservoirs à pression. Règlements et règles de l'art.

Paris (18e), Office central de l'Acétylène et de la Soudure autogène, 104, boulevard de Clichy. In-8° (13 × 21 cm.) de 138 pages avec 92 fig. et 1 planche.

In German.

1927 621 .87 (02

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Ergänzungsband zur zweiten Auflage der **Kranbau**-Berechnung und Konstruktion von **Kranen** aller Art.

Wittenberg bez. Halle. A. Ziemsen Verlag (17 × 24), XI + 252 Seiten mit 238 Abb. und 55 Tabellen. (Preis : 16 Rm.)

1923 62. (08

GRAF (Emerich).

Technische Berechnungen für die **Praxis des Maschinen- u. Bautechnikers.**

Leipzig, Verlag von Johann Ambrosius Barth. 5., durchgesehener Abdruck. VIII-374 Seiten. (Preis : 7 Rm.)

1927 691

GRAF (Otto).

Versuche über den Einfluss niederer Temperatur auf die Widerstandsfähigkeit von **Zementmörtel und Beton.**

Mailand (Italien), Libreria Internazionale Ulrico Hoepli, Galleria De Cristoforis. 4°. III + 44 Seiten, mit 19 Zsstellgn. u. 36 Textabb. (Preis : 23-25 lire.)

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[1] The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. See « Bibliographical Decimal Classification as applied to Railway Science », by L. Weissenbruch in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1927 721 .9 (02

Handbuch für **Eisenbetonbau.** Band 3. Der Baustoff u. s. Verarbeitg. Der Beton. Betonmischmaschinen. Fördern. u. Verarbeiten von Beton. Das Eisen u. s. Verarbeitg.

Mailand (Italien), Libreria Internazionale Ulrico Hoepli, Galleria De Cristoforis, 4°. xv + 427 Seiten mit 605 Textabb. (Preis : 117 lire.)

1927 385 .63

LŒNING (O.), Dr., Landgerichtsdirektor.

Kommentar zum Internationalen Uebereinkommen über den **Eisenbahnfrachtverkehr** (I. U. G.) vom 23. Oktober 1924.

Berlin, N. W. 7, Verlag von Georg Stilke. Nr. 63, Stilkes Rechtsbibliothek, 1081 Seiten. (Preis : 25 Rm.)

1927 621 .9

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Einzelantrieb von Werkzeugmaschinen. Ein Hilfsbuch für die gesamte Metall verarbeitende Industrie.

Leipzig, Verlag von Johann Ambrosius Barth. 8°, viii-224 Seiten mit 212 Abb. und 20 Tabellen. (Preis : 15 Rm.)

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MENZEL (E.).

Das Härten von Stahl und Eisen, nebst vielen Anleitungen aus der Praxis. 6., völlig neu bearb. Aufl. von C. E. **Berck.**

Leipzig, Verlag von Johann Ambrosius Barth. 8°, 112 Seiten mit 60 Abb. (Preis : 3 Rm.)

1927 621 .39

NEUMANN (A. J.).

Elektrische Widerstands- Schweissung und- Erwärmung.

Mailand (Italien), Libreria Internazionale Ulrico Hoepli, Galleria De Cristoforis. Gr. 8°. viii + 193 Seiten mit 250 Abb. (Preis : 78.75 lire.)

1927 691. (04 & 721 .9 (04

ROS, Prof., Dr.-Ing. h. c.

Die Druckelastizität des Mörtels und des Betons. Das elastische Verhalten von ausgeführten Beton- und Eisenbeton-Bauwerken.

Zürich, Verlag von « Laboratoire fédéral d'essai des matériaux annexé à l'Ecole polytechnique fédérale de Zurich ». 40 Seiten mit 50 Abb.

In English.

1927 744. (02

ALBERT (C. D.), M. E., M. Am. Soc. M. E., professor of machine design, Cornell University.

Machine design drawing room problems.

New York : John Wiley & Sons, London : Chapman & Hall. Second edition. (6 × 9 inches), 355 pages, illust. (Price : $3.50.)

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AMERICAN BANKERS ASSOCIATION. Committee o Commerce and Marine.

Automotive transportation and railroads. A study o relationship between highway and rail transport.

New York City, published by the Association, 8 pages.

1927 62. (01 (.73)

AMERICAN SOCIETY FOR TESTING MATERIALS.

A. S. T. M. standards adopted in 1926. Second supplement to the Book of Standards issued in 1924.

Philadelphia, Pa., published by the Society, 1315 Spruce Street. (Price : $1.50.)

1927 669. (02

BAMFORD (T. G.), M. Sc. & **HARRIS (Harold),** M. Sc., F. C. S.

The metallurgist's manual.

London, Chapman & Hall, Limited. (Price : 15 sh. net.)

1927 385. (09 (.73)

Coal and the Norfolk & Western Railway.

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1927 62. (02

DANA (Forest C.) & WILLMARTH (Elma H.).

Engineering problems manual.

London, McGraw-Hill Publishing Company, Limited. (Price : 10 sh. net.)

1927 656 .1 (01 & 656 .2 (01

DAVENPORT (E. H.).

Railways and roads.

London, published by The London General Press. (Price : 1 sh.)

1927 385 .588 & 621 .137.1

Feeding the iron hog. The life and work of a locomotive fireman.

Cleveland, Ohio, published by Brotherhood of Locomotive Firemen and Enginemen. 100 pages. (Price : 25 cents.)

1927 537 & 621 .3

FLEMING (J. A.), professor, D. Sc., F. R. S.

The interaction of pure scientific research and electrical engineering practice.

London. Constable and Company, Limited. (Price. 15 sh. net.)

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The Baltimore & Ohio Railroad Company and its subsidiaries. A bibliography.

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Electric traction.

Calcutta, Government of India Central Publication Branch. Technical paper No. 255. 52 pages, 13 tables in the text & 10 plates. (Price : Re. 1 As. 2 or 2 sh.)

1927 621 .31 (02

GUNTHERSCHULTZE, Prof., Dr.-Ing.

Electric rectifiers and valves. Translated and revised by Norman A. de Bruyne.

London, Chapman & Hall, Limited. (Price : 15 sh. net.)

1927 691. (02

HOOL (George A.), S. B., professor of structural engineering, University of Wisconsin.

Reinforced concrete construction. Vol. II : Retaining walls and buildings.

New York & London : McGraw-Hill Book Co., Inc. Second edition. (6 × 9 inches), 690 pages, 411 halftones and line cuts, 18 insert plates, many charts and tables. (Price : $6.00.)

1927 691

INSTITUTION OF CIVIL ENGINEERS. Seventh (interim) report of the Committee.

Department of scientific and industrial research. **The deterioration of structures of timber, metal, and concrete** exposed to the action of sea-water. Edited by John Purser and H. J. Grose.

London, His Majesty's Stationery Office. (Price : 2 s. net.)

1927 621 .89

LOCKHART (L. E.), consulting and analytical chemist.

American lubricants from the standpoint of the consumer.

Easton, Pa. (U. S. A.), The Chemical Publishing Company. Third edition. (6 × 9 inches), 408 pages, illust. (Price : $5.00.)

1927 536 & 62

MACCONOCHIE (Arthur F.).

Thermodynamics applied to engineering.

London, Longmans, Green & Company, Limited. (Price : 12 sh. 6 d. net.)

1927 385. (09 (.42)

MAC DERMOT (E. T.), M. A.

History of the Great Western Railway. Vol. I : 1833-1863. Parts I and II.

London, Great Western Railway Company, Paddington Station. (8 7/8 × 5 1/2 × 1 1/4 inches), 902 pages. (Price : 21 sh. per set of two parts.)

1927 693

MILLAR (William).

Plastering, plain and decorative. Edited and remodelled by George P. Bankart.

London, B. T. Batsford, Limited. Fourth edition. (Price : 30 sh. net.)

1927 385. (09.1 (.73)

Railroad map of the United States, prepared under direction of Chief of Engineers, U. S. Army. Single, multiple, and narrow-gauge track sections are indicated with notes on trackage rights and other important data.

Washington, D. C., published by Engineer Reproduction Plant, Washington Barracks. Four sheets which when joined form a wall map 7 × 5 feet.

1927 656 .235.2 (08 (.42)

RAILWAY CLEARING HOUSE.

Classification of dangerous goods by merchandise trains.

London, N. W. 1, Railway Clearing House, Seymour Street, Euston Square. (10 × 7 × 1/2 inches), 239 pages.

1927 656 .235.2 (08 (.42)

RAILWAY CLEARING HOUSE.

General railway classification of goods by merchandise trains.

London, N. W. 1, Railway Clearing House, Seymour Street, Euston Square. (9 5/8 × 6 1/8 × 1/2 inches), 282 pages.

1927 656 .235.2 (08 (.42)

RAILWAY CLEARING HOUSE.

Scales of standard charges for merchandise traffic (other than coal class) by merchandise trains.

London, N. W. 1, Railway Clearing House, Seymour Street, Euston Square. (13 1/4 × 8 3/4 × 3/4 inches.) (Price : 10 s.)

1927 656 .235.2 (08 (.42)

RAILWAY CLEARING HOUSE.

Scale of standard charges in respect of coal, coke and patent fuel by merchandise trains.

London, N. W. 1, Railway Clearing House, Seymour Street, Euston Square. (13 1/4 × 8 1/2 inches), 6 pages. (Price : 3 d.)

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ROBINSON (William).

Applied thermodynamics. A textbook covering the syllabuses of the B. Sc. (Eng.), A. M. Inst. C. E., and A. M. I. Mech. E. Examinations in this subject.

London, Sir Isaac Pitman & Sons. (Price : 18 sh. net.)

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London, Baillière, Tindall & Cox. (Price : 34 sh. net.)

1927 313 .385 (.942) & 385. (08 (.942)

SOUTH AUSTRALIAN RAILWAYS.

Annual report of the South Australian Railways Commissioner for the year 1926-1927.

Adelaide, Harrison Weir, Government Printer, North Terrace. xxxii-32 pages, 21 tables, fig. & a map.

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STODOLA (A.), Dr.

Steam and gas turbines, with a supplement on the prospects of the thermal prime mover. Authorized translation from the sixth German edition by Dr. Louis C. Lœwenstein.

New York, McGraw-Hill Book Co., Inc. (7 1/4×10 1/4 inches), 1 356 pages, 1 565 illust., 7 folding charts, 2 vols. (Price : $15.00.)

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THOMPSON (Slason).
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New York : John Wiley & Sons, Inc. London : Chapman and Hall, Limited. (Price : 50 s. net.)

1927 536
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Pyrometry.
London, McGraw-Hill Publishing Company, Limited. (Price : 15 sh. net.)

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Arts et Métiers. (Paris.)

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MARCOTTE (E.). — **Nouveau règlement pour le calcul des ponts.** (2 900 mots.)

Bulletin de la Société d'encouragement pour l'industrie nationale. (Paris.)

1927 621 .392
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Les chemins de fer de l'Etat turc. (500 mots.)

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Statistique des chemins de fer suédois pour les exercices de 1920 à 1924. (200 mots & tableau.)

Bulletin de l'Union internationale des chemins de fer (Paris).

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1927 385 .113 (.469)
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Les Chemins de fer portugais de la Beira Alta. (1 000 mots & 8 tableaux.)

Chronique des transports. (Paris.)

1927 385 .571 (.44)
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L'exode des hauts fonctionnaires. (1 200 mots.)

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L'augmentation de capital du Southern Railway : la part réservée au personnel. (1 000 mots.)

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L'impôt sur les transports. (1 600 mots.)

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DUPLAIX (E.). — **Calcul d'une pièce en béton armé à section rectangulaire, soumise à la flexion composée.** (1 700 mots & fig.)

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Les **chaudières à haute pression à chauffage indirect.** Nouvelle chaudière à haute pression, système Schmidt. (700 mots & fig.)

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Voies de quai du réseau du Nord, en **rails Broca,** avec aiguillages spéciaux. (500 mots & fig.)

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1927 669 .1
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Le durcissement superficiel des aciers par mitraillage. (800 mots, 1 tableau & fig.)

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BOLOMEY (J.). — **Durcissement des mortiers et bétons.** (2 300 mots & fig.)

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Les chemins de fer et les tramways. (Paris.)

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L'utilisation de la **voie étroite.** (2 800 mots & fig.)

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Bloc d'enraiement pour wagons. (350 mots & fig.)

L'Industrie des voies ferrées et des transports automobiles. (Paris.)

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SCHOPFER (J.). — Etude d'un **coefficient extrême d'adhérence.** (650 mots & fig.)

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BUCHHOLZ. — Der **Rippenplatten-Oberbau auf Holzschwellen.** (4 200 Wörter, 2 Tabellen u. Abb.)

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BAUMANN (E.). — **Der Wärmeübergang im Lokomotivkessel** unter besonderer Beücksichtigung der Strahlung. (3 400 Wörter, 1 Tabelle & Abb.)

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Bulletin, American Railway Engineering Association. (Chicago.)

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Bull. Amer. Railway Engineering Ass^{on}, August, p. 31.
FORD (R. B.). — **The highway grade crossing problem.** (6 600 words.)

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GRIME (E. M.). — **Water treatment from the standpoint of railroad efficiency.** (4 200 words.)

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RAPS (J. F.). — **The value of boiler water treatment to the mechanical department.** (1 800 words.)

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BARR (W. M.). — **The treatment of water for locomotives from the standpoint of the chemical engineer.** (4 200 words.)

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ROMER (J. B.). — **Boiler feed water treatment** from a manufacturer's viewpoint. (3 000 words.)

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Sedimentation with and without chemicals, pressure and gravity filters, deconcentrators and continuous blow-down apparatus. (4 900 words.)

1927 621 .133.7
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Pretreatment of boiler feed water. (3 600 words.)

1927 621 .133.7
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Present knowledge of foaming and priming of **boiler** water, with suggestions for research. (6 000 words.)

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Embrittlement of steel. (7 800 words.)

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HARDEN (R. S.). — **Sink-head ingots.** (25 000 words, tables & fig.)

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PARODI (H.). — **Traffic capacity of a railway.** (6 000 words & fig.)

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AMERICAN ELECTRIC RAILWAY ASSOCIATION. — Second Cleveland **Convention** eclipses last year's. (93 000 words & fig.)

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Improved wheel equipment for Chicago. (900 words & fig.)

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1927 62 .(01 & 669
The Metallurg., p. 131, Suppl. to the Engineer, No. 3742, 30 September.
Corrosion fatigue. (1 200 words.)

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The effect of temperature on the properties of steels. (1 000 words & 2 tables.)

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Defects in mild steel. (1 200 words & fig.)

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The failure of bars under impact. (1 200 words & fig.)

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Cracking and corrosion in boiler plates. (800 words.)

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An American diary. The Illinois Central Railroad. (2 200 words & fig.)

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L. M. and S. Railway locomotive « Royal Scot ». (400 words & fig.)

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The locomotive industry. (900 words.)

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The Amsterdam Congress for testing materials. (2 800 words.)

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Machining locomotive cylinders. (500 words & fig.)

1927 536
Engineer, No. 3744, October 14, p. 420.
The transfer of heat in cylinder walls. (4 000 words.)

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ROSENHAIN (W.). — **The plastic deformation and fracture of metals.** (5 600 words.)

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The Tournelle bridge, Paris. (500 words & fig.)

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1927 621. 134.3 (.494)
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The development of the extra-high-pressure locomotive. (400 words.)

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Institution of Mechanical Engineers. Excerpts from the address by the President, Sir Henry Fowler, K. B. E., Ll. D. (4 500 words.)

1927 621 .8 (.944)
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Erecting **cranes** for Sydney harbour bridge. (2 600 words & fig.)

1927 621 .13 (01

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WITHAM (T.). — Recent british locomotives. (3 400 words & fig.)

1927 625 .29 (.42)

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A railway coach washing machine. (400 words & fig.)

1927 669

The Metallurg., p. 146, Suppl. to the Eng., No. 3746, October 28.

Non-metallic enclosures. (1 200 words.)

1927 62. (01 & 669

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Rockwell and Brinell hardness numbers. (1 100 words.)

1927 62. (01 & 669

The Metallurg., p. 149, Suppl. to the Engin., No. 3746, October 28.

Local and uniform extension in the tensile test. (800 words & fig.)

1927 62. (01 & 669 .1

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JONES (J. A.). — The effect of manganese on the properties of low-carbon steels. (1 000 words, 3 tables & fig.)

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The flow of metals in forging. (900 words.)

1927 669 .1

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Locomotive forging steels. (1 000 words & fig.)

Engineering. (London.)

1927 62. (01 & 621 .116

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BARKER (L. H.). — The calculation of temperature stresses in tubes. (650 words & fig.)

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Engineering, No. 3221, October 7, p. 452.

The Holborn mechanical tandem telephone exchange. (1 200 words & fig.)

1927 621 .31

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CLOTHIER (H. W.). — Switchgear for alternating current. (4 600 words & fig.)

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Engineering, No. 3221, October 7, p. 470.

HERBERT (E. G.). — The work-hardening of steel by abrasion. (2 700 words, 5 tables & fig.)

1927 669 .1

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WHITELEY (J. H.). — The solution of cementite in α-iron and its precipitation. (3 000 words, 2 tables & fig.)

1927 691

Engineering, No. 3222, October 14, p. 475.

The deterioration of structures in sea water. (2 700 words.)

1927 621 .33

Engineering, No. 3222, October, 14, p. 491.

A case for electric traction. (2 200 words.)

1927 621 .31 (.42)

Engineering, No. 3223, October 21, p. 527.

The ferrybridge station of the Yorkshire electric power Company. (2 000 words & fig.)

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FOWLER (Sir Henry). — The Institution of Mechanical Engineers. Presidential address. (6 200 words.)

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Engineering, No. 3224, October 28, p. 550.

The Parwinac oil-burning apparatus. (1 200 words & fig.)

1927 624 .2

Engineering, No. 3224, October 28, p. 563.

GILCHRIST (J.). — Experiments on shearing strength of reinforced concrete beams. (300 words, 2 tables & fig.)

1927 656. (01

Engineering, No. 3225, November 4, p. 577.

TRENCH (E. F. C.). — The Institution of Civil Engineers. Presidential address. (5 800 words.)

1927 621 .165

Engineering, No. 3225, November 4, p. 579.

Tests of a 11 000-kw. Zoelly steam turbine. (500 words & 1 table.)

1927 621. 134.1 & 669 .1

Engineering, No. 3225, November 4, p. 581.

Centrifugal castings for locomotive piston-valve bushings. (1 200 words & fig.)

1927 62. (01 & 721 .3

Engineering, No. 3225, November 4, p. 586.

The reinforced concrete column. (1 200 words.)

Engineering News-Record. (New York.)

1927 621 .31 (.44)

Engineering News-Record, No. 12, Sept. 22, p. 458.

DESBLEDS (L. B.). — Large hydro-electric plant at Eguzon, France. (1 400 words & fig.)

1927 625 .13 (.73)

Engineering News-Record, No. 12, Sept. 22, p. 464.

SMITH (S. M.). — Wabash Ry. builds new bridge over Sangamon River. (1 600 words & fig.)

1927 725 .4 (.73)
Engineering News-Record, No. 13, Sept. 29, p. 496.
BELL (N. J.). — Large one-story **industrial building**; 2 400 × 500 ft. (2 800 words & fig.)

1927 621 .33 (.54) & 625 .111 (.54)
Engineering News-Record, No. 13, Sept. 29, p. 502.
Mountain revision on main-line railway in India. (1 500 words & fig.)

1927 62. (01
Engineering News-Record, No. 13, Sept. 29, p. 517.
FEE (D. J.). — **Strength of materials and some confusing teachings.** (2 500 words & fig.)

1927 625 .111 (.73) & 656 .213 (.73)
Engineering News-Record, No. 14, October 6, p. 540.
LYONS (P. F.). — **New railway in Louisiana cuts off long ferry transfer.** (1 400 words & fig.)

1927 721 .4 (.73)
Engineering News-Record, No. 14, October 6, p. 542.
BLOOD (H. F.). — Structural details of a **steel-framed hemispherical dome.** (1 000 words & fig.)

1927 62. (01 & 669 .1
Engineering News-Record, No. 14, October 6, p. 548.
NORRIS (E. B.). — **Plastic flow and the strength of cold-worked steel.** (1 600 words & fig.)

1927 656 .212.6
Engineering News-Record, No. 14, October 6, p. 550.
FRITH (H. W.). — **Narrow grain pier** built to form unit of future pier. (1 800 words & fig.)

1927 621 .39 (.945)
Engineering News-Record, No. 15, October 13, p. 589.
Structural welding of gas plant, Melbourne, Australia. (1 400 words & 1 table.)

1927 624. (01
Engineering News-Record, No. 15, October 13, p. 590.
SVERDRUP (L. J.). — Cantilever erection of long spans of Missouri River **bridge.** (1 000 words & fig.)

1927 691
Engineering News-Record, No. 15, October, 13, p. 597.
HILL (C. S.). — **Winter construction methods and plant.** (2 000 words & fig.)

1927 691
Engineering News-Record, No. 15, October 13, p. 604.
COLLINS (T.). — Rapid test for **water content of damp aggregates.** (750 words & fig.)

1927 624 .51 (.73)
Engineering News-Record, No. 16, October 20, p. 620.
STEINMAN (D. B.). — Ohio river **suspension bridge** at Portsmouth. (6 500 words & fig.)

1927 62. (01 & 691
Engineering News-Record, No. 16, October 20, p. 628.
Fire resistance of brick walls under working load. (350 words & 1 table.)

1927 625 .111 (.85
Engineering News-Record, No. 16, October 20, p. 635.
Avalanches compel railway relocation with tunnel i Peru. (500 words.)

Great Western Railway Magazine. (London.)

1927 625 .4 (.42
Great Western Ry. Magazine, November, p. 433.
The Post Office (London) « **tube** » railway. (1 20 words & fig.)

Journal, Permanent Way Institution. (London.)

1927 625 .13 (.42
Journal, Perm. Way Inst., August, p. 133.
BUTLAND (W. E.). — Reconstruction of a **Cornis viaduct.** (6 300 words & fig.)

1927 627 (.42
Journal, Perm. Way Inst., August, p. 146.
PRICE (W. W.). — **Sinking cylinders by compresse** air. (1 600 words & fig.)

1927 625 .1 (0
Journal, Perm. Way Inst., August, p. 150.
SOUNDY (D. F.). — Economies in expenditure — **engineering department.** (8 300 words.)

Locomotive, Firemen & Enginemen's Magazine (Cleveland [Ohio].)

1927 385. (06.4 (.73)
Loc. Firemen & Enginemen's Mag., October, p. 303.
« **The fair of the Iron Horse** ». **Centenary exhibitio** and pageant of the Baltimore & Ohio Railroad. (9 00 words & fig.)

Locomotive Railway Carriage & Wagon Review. (London.)

1927 621 .335 (.494)
Loc. Ry. Carriage & Wagon Review, October 15, p. 316
New powerful electric locomotives for the Loetschberg Railway. (1 400 words & fig.)

1927 621 .134.3 (.42)
Loc. Ry. Carriage & Wagon Review, October 15, p. 320
BREWER (F. W.). — **Modern locomotive superheat** ing on the G. W. Ry. Its application to tank engines (2 700 words.)

London & North Eastern Railway Magazine. (London.)

1927 656 .222.6 (.42)
L. & N. E. Railway Magazine, November, p. 482.
York debating society. (1 800 words.)

Mechanical Engineering. (New York.)

1927 621 .116. (01
echanical Engineering, October, p. 1063.
SMITH (M. B.). — Factors governing the purchase coal. (3 700 words.)

1927 621 .89 (01
echanical Engineering, October, p. 1068.
NORTHCUTT (W. O.). — **Lubricating power cylin-rs** of Diesel engines. (2 300 words & fig.)

1927 614 .7 (.73) & 621 .133.4 (.73)
echanical Engineering, October, p. 1071.
WHITLOCK (E. H.). — **Smoke-abatement methods** ed in Cleveland. (3 800 words & fig.)

1927 621 .116. (01
echanical Engineering, October, p. 1076.
DANIELS (F. H.). — The characteristics of **modern okers.** (2 700 words & fig.)

1927 621 .116. (01
echanical Engineering, October, p. 1079.
AZBE (V. J.). — **Industrial furnaces.** (2 800 words fig.)

1927 621 .116. (01
echanical Engineering, October, p. 1085.
SHERMAN (R. A.) & RICE (W. E.). — Refractories ervice conditions in a furnace burning Pittsburgh coal **underfeed stokers.** (4 300 words, 3 tables & fig.)

1927 62. (01 & 621 .116. (01
echanical Engineering, October, p. 1093.
WHITE (A. E.) & CLARK (C. L.). — Properties of **oiler tubing** at elevated temperatures determined by xpansion tests. (2 800 words, 3 tables & fig.)

1927 62. (01
echanical Engineering, October, p. 1097.
WINSLOW (A. M.) & EDMONDS (R. H. G.). — ests and theory of **curved beams.** (5 300 words & fig.)

1927 621 .89 (01
echanical Engineering, October, p. 1109.
NIELSEN (H.) & BAKER (S.). — **Lubricating oils** rom coals. (1 000 words & fig.)

1927 62. (01 & 669
echanical Engineering, October, p. 1111.
Effect of temperature on the **properties of metals.** 1 800 words & fig.)

1927 621 .116. (01
echanical Engineering, October, p. 1115.
Determination of most economical **condenser installa-on** for a given power plant. (5 500 words & fig.)

1927 621 .138.5 (.73) & 625 .26 (.73)
echanical Engineering, October, p. 1120.
HARRISON (W. R.). — The management of **railway nops and terminals.** (5 400 words.)

1927 621 .116
Mechanical Engineering, October, p. 1144.
Scheme for the identification of **piping systems.** (3 600 words.)

Modern Transport. (London.)

1927 621 .13 (01 (.42)
Modern Transport, No. 447, October 8, p. 3.
GRESLEY (H. N.). — **Building of railway locomotives.** Present position in Great Britain. (1 700 words & fig.)

1927 385. (09.1 (.54)
Modern Transport, No. 447, October 8, p. 4.
Railway development in Ceylon. (1 400 words & fig.)

1927 621 .132.8 (.62)
Modern Transport, No. 447, October 8, p. 7.
Steam rail car for Egyptian State Railways. (1 300 words & fig.)

1927 385 .6
Modern Transport, No. 447, October 8, p. 13.
International transit. Third League of Nations conference (1 300 words.)

1927 621 .132.8 (.54)
Modern Transport, No. 448, October 15, p. 3.
Rail coaches for India. Drewry cars for the Kalka-Simla Railway. (1 300 words & fig.)

1927 621 .33 (.494)
Modern Transport, No. 448, October 15, p. 5.
SMITH (R. T.). — **Electrification** of main line railways. (1 200 words et fig.)

1927 621 .134.2 (.42)
Modern Transport, No. 448, October 15, p. 8.
A successful locomotive development. **Beardmore-Caprotti valve gear.** (1 900 words, 1 table & fig.)

1927 656 .1 (.42) & 656 .2 (.42)
Modern Transport, No. 448, October, 15, p. 11.
Road and rail transport. Views of the motor trade. (1 000 words.)

1927 621 .132.6 (.42)
Modern Transport, No. 449, October 22, p. 7.
New light steam unit for railway work. (800 words & fig.)

1927 385 .11 (.944)
Modern Transport, No. 451, November 5, p. 7.
Railway problems in New South Wales. (900 words.)

1927 385. (09 (.66)
Modern Transport, No. 451, November 5, p. 7.
Railway position in Kenya and Uganda. (1 000 words.)

1927 656 .25 (01
Modern Transport, No. 451, November 5, p. 8.
Signalling and railway operation. (1 400 words.)

1927 656 .23 (01

Modern Transport, No. 451, November 5, p. 9.

BURTT (P.). — **Railways and traders.** (1 200 words.)

1927 656 .1 (.42) & 656 .2 (.42)

Modern Transport, No. 451, November 5, p. 11.

Railways and roads. Seriousness of the position. (800 words.)

Proceedings, American Society of Civil Engineers. (New York.)

1927 621 .6 (01

Proceed. American Soc. Civil Engineers, October, p. 1775.

SHERZER (A. F.). — New theory for the **centrifugal pump.** (7 600 words & fig.)

1927 62. (01 & 721 .4

Proceed. American Soc. Civil Engineers, October, p. 1893.

FOWLER (F. H.). — A graphic method for determining the **stresses in circular arches** under normal loads by the Cain formulas. (2 600 words, 3 tables & fig.)

1927 526 (.73)

Proceed. American Soc. Civil Engineers, October, p. 1919.

BIRDSEYE (C. H.). — **Surveying and mapping** in the United States. (4 600 words.)

Proceedings, Institution of Civil Engineers. (London.)

1926-1927 625 .1 (.54) & 627 (.54)

Proceed., Institut. of Civil Eng., Part I, p. 4.

PALMER (F.). — **Engineering works** in India. (13 000 words & fig.)

1926-1927 656 .211 (.42)

Proceed., Institut. of Civil Eng., Part I, p. 168.

ELLSON (G.). — The remodelling of **Charing Cross and Cannon Street Stations.** (11 000 words & fig.)

Proceedings, Institution of Railway Signal Engineers. (Manchester.)

1927 656 .254. (01

Proceed. Instit. Ry. Signal Eng., Part I, Feb. to Aug., p. 31.

Railway level crossings. (14 000 words.)

1927 656 .25 (01

Proceed. Instit. Ry. Signal Eng., Part I, Feb. to Aug., p. 68.

PROUD (H. M.). — A talk on **some signalling overseas.** (7 600 words.)

1927 656 .253 (.42)

Proceed. Instit. Ry. Signal Eng., Part I, Feb. to Aug., p. 89.

THORROWGOOD (W. J.). — **Four-aspect colour light signals and power signalling** in practice. (12 600 words, 4 tables & fig.)

1927 656 .25 (.44)

Proceed. Instit. Ry. Signal Eng., Part I, Feb. to Aug., p. 131.

LASCELLES (T. S.). — **Visit to signalling installations** on the Northern Railway of France. (4 200 words & fig.)

Railway Age. (New York.)

1927 385. (06.4 (.73)

Railway Age, No. 13, Section one, Sept. 24, p. 555.

Iron horse fair opens to-day. Baltimore & Ohio centenary exhibition. (4 400 words & fig.)

1927 625 .14 (06 (.73)

Railway Age, No. 13, Section one, Sept. 24, p. 563.

Roadmasters consider broader problems of their work. (9 800 words & fig.)

1927 621 .335 (.73)

Railway Age, No. 13, Section one, Sept. 24, p. 569.

WALSH (R.). — Great Northern **electric locomotives.** (2 400 words & fig.)

1927 621 .139. (01 (.73), 625 .18 (01 (.73) & 625 .27 (01 (.73)

Railway Age, No. 13, Section one, Sept. 24, p. 573.

WESTON (R. A.). — The neglected science of **railway storekeeping.** (2 300 words & fig.)

1927 656 .1 (.73) & 656 .2 (.73)

Railway Age, No. 13, Section two, Sept. 24, p. 603.

Railway bus and truck operation tabulated. (350 words, tables & fig.)

1927 621 .14 (.5) & 656 .1 (.5)

Railway Age, No. 13, Section two, Sept. 24, p. 606.

WARNER (A. P.). — **Buses** conquer the Syrian desert. (1 900 words & fig.)

1927 725 .4 (.73)

Railway Age, No. 13, Section two, Sept. 24, p. 609.

Pointers on garage design from a manufacturer. (5 300 words & fig.)

1927 656 .261 (.73)

Railway Age, No. 13, Section two, Sept. 24, p. 617.

« **Freightainers** » on Boston & Maine furnish door-to-door service. (1 300 words & fig.)

1927 656 .212:5 (.73)

Railway Age, No. 14, October 1, p. 629.

Putting 225 cars an hour over two humps. (3 200 words, 3 tables & fig.)

1927 625 .1 (.73)

Railway Age, No. 14, October 1, p. 633.

Second track work involves extensive **line revision.** (2 900 words & fig.)

1927 621 .139 (.71) & 621 .39 (.71)

Railway Age, No. 14, October 1, p. 638.

BOONE (G. T.). — « **Reclamation** » **carried far on** Canadian National. (2 400 words & fig.)

1927 621 .33 (01 (.4)
Railway Age, No. 14, October 1, p. 641.
HEALY (K. T.). — « Battle of systems » in European **electrification**. (3 600 words & fig.)

1927 621 .136 (.73)
Railway Age, No. 14, October 1, p. 644.
Norfolk & Western builds **tenders of large capacity.** (300 words & fig.)

1927 656 .237. (01
Railway Age, No. 14, October 1, p. 647.
GREANEY (E. J.). — Are **accounting reserves** sound? (3 300 words.)

1927 621 .132.5 (.73)
Railway Age, No. 15, October 8, p. 669.
Erie acquires **2-8-4 locomotives for freight service.** (1 400 words & fig.)

1927 625 .245 (.73)
Railway Age, No. 15, October 8, p. 672.
Illinois Central **air brake car remodeled.** (700 words & fig.)

1927 625 .14 (01
Railway Age, No. 15, October 8, p. 673.
RAY (G. J.). — The economics of **heavy track construction.** (2 900 words & fig.)

1927 625 .143.2 (.73)
Railway Age, No. 15, October 8, p. 681.
GENNET, Jr. (C. W.). — Some open questions in **rail specifications.** (2 000 words.)

1927 656 .254. (06 (.73)
Railway Age, No. 15, October 8, p. 682.
Telegraph and telephone section A. R. A., meeting. (600 words.)

1927 614 .8 (.73)
Railway Age, No. 15, October 8, p. 684.
Safety work reduces drain on railway resources. (3 100 words & fig.)

Railway Engineer. (London.)

1927 621 .134.2 (.42)
Railway Engineer, November, p. 397.
British application of **Caprotti valve gear.** (1 200 words, 1 table & fig.)

1927 621 .131.3
Railway Engineer, November, p. 399.
Wanted : a national **locomotive testing plant.** (1 800 words.)

1927 625 .232 (.68)
Railway Engineer, November, p. 405.
Experimental double-deck carriage, South African Railways. (900 words & fig.)

1927 621 .132.3 (.44)
Railway Engineer, November, p. 413.
Mountain type locomotives in France. (800 words & fig.)

1927 621 .132.6 (.43)
Railway Engineer, November, p. 415.
New 2-6-2 mixed traffic locomotives for German Railways. (600 words & fig.)

1927 625 .123 (.42)
Railway Engineer, November, p. 416.
Thrust-boring for **drainage purposes.** (1 400 words & fig.)

1927 625 .232 (.42)
Railway Engineer, November,p. 418.
New first-class coaches, L. M. S. R. (400 words & fig.)

1927 621 .132.3 (.71) & 621 .132.5 (.71)
Railway Engineer, November, p. 422.
New 4-8-4 type locomotives in Canada. (1 000 words & fig.)

1927 51. (08
Railway Engineer, November, p. 425.
Tables for setting out curves by offsets from tangents. (250 words, tables & fig.)

Railway Gazette & Railway News. (London.)

1927 385 .113 (.494) & 621 .33 (.494)
Railway Gazette & News, No. 16, October 14, p. 455.
Swiss **railway electrification results.** (2 200 words & fig.)

1927 313 .385.5 (.42)
Railway Gazette & News, No. 16, October 14, p. 457.
Census of **railway employees.** (250 words & table.)

1927 385. (09.1 (.53)
Railway Gazette & News, No. 16, October 14, p. 458.
The **pilgrims' railway** to Medina. (1 200 words & fig.)

1927 385. (06.4 (.73)
Railway Gazette & News, No. 16, October 14, p. 459.
The Baltimore & Ohio **Railroad centenary.** (850 words & fig.)

1927 725 .23 (.42)
Railway Gazette & News,, No. 17, October 21, p. 485.
New head offices for the « Underground ». (500 words & fig.)

1927 656 .1 (.42) & 656 .2 (.42)
Railway Gazette & News, No. 17, October 21, p. 488.
Rail versus road in milk transport. (1 000 words & fig.)

1927 656 .222 (.42)
Railway Gazette & News, No. 17, October 21, p. 489.
Improving G. W. R. **freight-train services.** (1 600 words.)

1927 656 .222 (.42)
Railway Gazette & News, No. 17, October 21, p. 491.
Speeding up freight movement. (2 300 words & 1 table.)

1927 656 .234. (01
Railway Gazette & News, No. 18, October 28, p. 512.
Are **passenger service costs** excessive? (900 words.)

1927 656 .281. (01
Railway Gazette & News, No. 18, October 28, p. 518.
Some notes on unexplained **derailments.** (3 500 words, 1 table & fig.)

1927 625 .29 (.42)
Railway Gazette & News, No. 18, October 28, p. 521.
New car-cleaning methods on the « Underground ». (250 words & fig.)

1927 625 .245 (.82)
Railway Gazette & News, No. 18, October 28, p. 522.
Special brake vans, Buenos Ayres Great Southern Railway. (200 words & fig.)

1927 656 .254 (.54)
Railway Gazette & News, No. 18, October 28, p. 523.
Private telephone installation G. I. P. Railway. (750 words & fig.)

1927 016 .656 (.42)
Railway Gazette & News, No. 19, November 4, p. 544.
The co-ordination of **transport information.** (900 words.)

1927 656 .253 (.42)
Railway Gazette & News, No. 19, November 4, p. 548.
One-lever system of **route signalling** at Newport, Mon., G. W. R., Station. (2 700 words & fig.)

1927 621 .132.8 (.54)
Railway Gazette & News, No. 19, November 4, p. 555.
New metre-gauge **Garratt locomotive,** Burma Railways. (800 words & fig.)

1927 656 .2 (01 (.42)
Railway Gazette & News, No. 19, November 4, p. 556.
Development of **inland transport.** (2 400 words.)

1927 656 .281 (.42)
Railway Gazette & News, No. 19, November 4, p. 570.
The Sevenoaks **railway accident.** Coroner's inquest and verdict. (1 000 words.)

1927 656 .253 (.42)
Railway Gazette & News, No. 19, November 4, p. 570.
New signalling for the Southern Railway. (500 words.)

Railway Magazine. (London.)

1927 385. (09.1 (.42)
Railway Magazine, November, p. 341.
HOPWOOD (H. L.). — **The Isle of Man Railway** and its locomotives. (3 700 words, 1 table & fig.)

1927 656 .222 (.42)
Railway Magazine, November, p. 349.
British express trains in the summer of 1927. (3 700 words & tables.)

1927 656 .222.1 (.42)
Railway Magazine, November, p. 374.
ALLEN (C. J.). — **British locomotive practice and performance.** (4 700 words, 4 tables & fig.)

Railway Mechanical Engineer. (New York.)

1927 621 .132.5 (.73)
Railway Mechanical Engineer, October, p. 638.
Denver & Rio Grande Western buys ten **2-8-8-2 type locomotives.** (1 900 words, 1 table & fig.)

1927 621 .13 (06 (.73)
Railway Mechanical Engineer, October, p. 647.
Traveling engineers hold thirty-fith convention. (6 000 words & fig.)

1927 385 .586 (.73)
Railway Mechanical Engineer, October, p. 654.
GRAY (T. C.). — **Railway trades training.** (3 500 words & fig.)

1927 625 .235. (06 (.73)
Railway Mechanical Engineer, October, p. 658.
Equipment painting section meets at Louisville. (5 400 words & fig.)

1927 625 .232 (.73)
Railway Mechanical Engineer, October, p. 665.
Aluminum used extensively in new Chicago & North Western **suburban cars.** (1 500 words & fig.)

1927 625 .26 (01 (.73)
Railway Mechanical Engineer, October, p. 667.
GHENOWETH (E. G.). — **Securing car shop efficiency.** (1 500 words & fig.)

1927 625 .26 (.73) & 725 .33 (.73)
Railway Mechanical Engineer, October, p. 670.
New Haven **passenger car repairs** at Readville shops. (1 500 words, 1 table & fig.)

1927 621 .138. (06 (.73) & 625 .26 (06 (.73)
Railway Mechanical Engineer, October, p. 674.
Record attendance at **General foremen's convention.** (9 000 words & fig.)

1927 621 .9 (06 (.73)
Railway Mechanical Engineer, October, p. 683.
Tool foremen hold annual meeting. (4 000 words & fig.)

Railway Signaling. (Chicago.)

1927 656 .253 (.71) & 656 .258 (.71)
Railway Signaling, October, p. 368.
TILLETT (C. H.). — Canadian National provides remote **power switches** at international bridge. (1 400 words & fig.)

1927 656 .256.3 (.71)
Railway Signaling, October, p. 372.
HODGDON (C. R.). — Canadian Pacific installs **signals** and remote control switches. (1 300 words & fig.)

1927 656 .256.3 (.71)
Railway Signaling, October, p. 376.
Canadian National **signaling construction standards** are high. (3 000 words & fig.)

1927 656 .256.2 (.71)
Railway Signaling, October, p. 381.
Canadian Pacific installs remote **power switch at rebuilt interlocker.** (1 700 words & fig.)

1927 656 .25 (06 (.71+.73)
Railway Signaling, October, p. 384.
Signal Section, American Railway Association, meets in Montreal. (16 000 words, 2 tables & fig.)

South African Railways and Harbours Magazine. (Johannesburg.)

1927 621 .14 (.68) & 656 .1 (.68)
South African Rys. & Harbours Mag., Sept., p. 1516.
The road motor services operated by the South African Railways & Harbours Administration. (2 000 words & fig.)

1927 385. (09.1 (.68)
South African Rys. & Harbours Mag., October, p. 1680.
The Railways of Rhodesia. (2 300 words & fig.)

University of Illinois Bulletin. (Urbana.)

1927 656 .221
University of Illinois Bulletin, No. 45, July 12, p. 1.
SCHMIDT (E. C.). — **Freight train curve resistance** on a one-degree curve and on a three-degree curve. (9 300 words, 12 tables & fig.)

In Spanish.

Boletin de Obras Públicas de la República Argentina. (Buenos Aires.)

1927 347 .762 (.82)
Boletin de Obras Públicas, Agosto, p. 662.
CASTELLO (M. F.). — **La prescripcion en los contratos de transporte.** (3 200 palabras.)

Gaceta de los Caminos de hierro. (Madrid.)

1927 388 (.73) & 625 .13 (.73)
Gaceta de los Caminos de hierro, nº 3258, 20 de octubre, p. 319.
Construcción en Nueva York del tercer metropolitano. (1 800 palabras.)

Ingenieria y Construcción. (Madrid.)

1927 621 .115
Ingenieria y Construcción, noviembre, p. 542.
RODRIGUEZ-RODA (P.). — **La condensación del vapor en las máquinas.** (3 900 palabras & fig.)

1927 621 .332 (.43)
Ingenieria y Construcción, noviembre, p. 553.
COHN & SCHUMACHER. — **La tecnica alemana en lineas de alta tensión.** (2 800 palabras & fig.)

Revista de Obras Públicas. (Madrid.)

1927 624 .32 (.460)
Revista de Obras Publicas, nº 18, 15 de sept., p. 365.
VALVERDE (P.). — **Corrimiento lateral de cuatro tramos metálicos sobre el rio Guadiana.** (1 000 palabras & fig.)

1927 624 .63 (.460)
Revista de Obras Publicas, nº 20, 15 de octubre, p. 394.
CEBALLOS PABON (R.). — **Nuevo puente de hormigón en masa sobre el rio Zújar.** (1 900 palabras, 1 cuadro & fig.)

1927 624 .32 (.460)
Revista de Obras Publicas, nº 21, 1º de nov., p. 421.
LOPEZ RODRIGUEZ (J.). — **Pruebas del puente sobre el rio Andaráx (o Almeria), en la carretera de Almeria a la cuesta de Los Castaños, por Níjar.** (1 800 palabras & fig.)

In Italian.

Rivista delle comunicazioni ferroviarie. (Roma.)

1927 656 .23
Riv. delle Comunic. ferrov., nº 21, 1º nov., p. 17.
SPINELLI (O.). — **Orientazioni straniere sul problema delle tariffe ferroviarie.** (2 300 parole & tabelle.)

In Dutch.

De Ingenieur. (Den Haag.)

1927 385. (09.1 (.92)
De Ingenieur, nº 38, 17 September, p. 813.
VAN HEEL (M. G.). — **Het spoorwegwezen op Java.** (7 800 woorden, 4 tafereelen & fig.)

1927 385 .21
De Ingenieur, nº 38, 17 September, p. 839.
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1927 625 .61 (.92)
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De Ingenieur, n° 42, 15 October, p. 929.

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1927 625 .232

De Ingenieur, n° 43, 22 October, p. 957.

VAN DER WAERDEN (J.). — **Stalen spoorwegrijtuigen.** (1 200 woorden & fig.)

1927 625 .1 (.44)

De Ingenieur, n° 44, 29 October, p. 965.

MOUTIER (A.). — Aperçu d'ensemble sur le travail de **reconstitution du système ferroviaire dans les régions du Nord de la France,** envahies et dévastées pendant la guerre, en notant au passage les méthodes auxquelles la Compagnie du Chemin de fer du Nord a eu recours, aussi bien pour la réfection de son outillage anéanti que pour assurer le bien-être de ses agents à qui on demandait un effort particulièrement important et soutenu dans des régions où on manquait de tout. (9 200 woorden & fig.)

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1927 625 .236 (.73) & 656 .1 (.73)

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1927 624 .6 (.438)

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1927 656 .234 (.81) & 656 .235 (.81)

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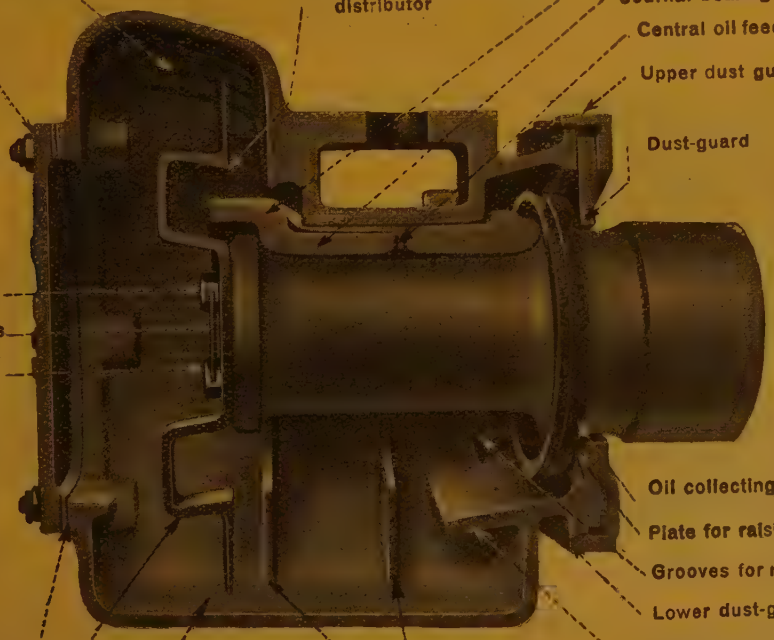
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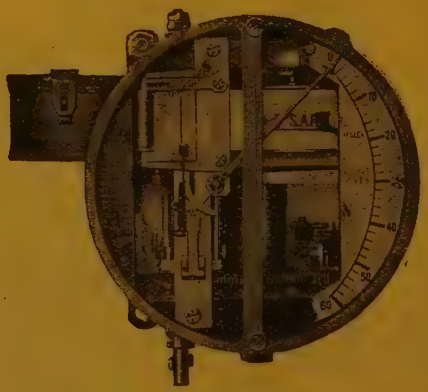

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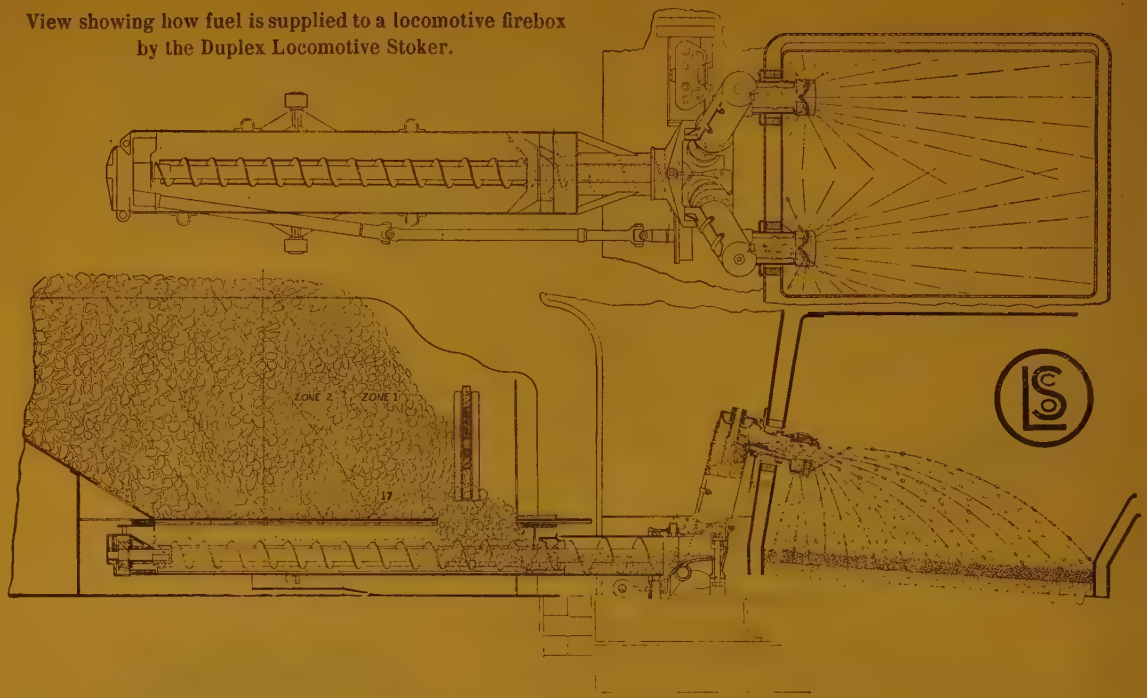

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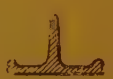

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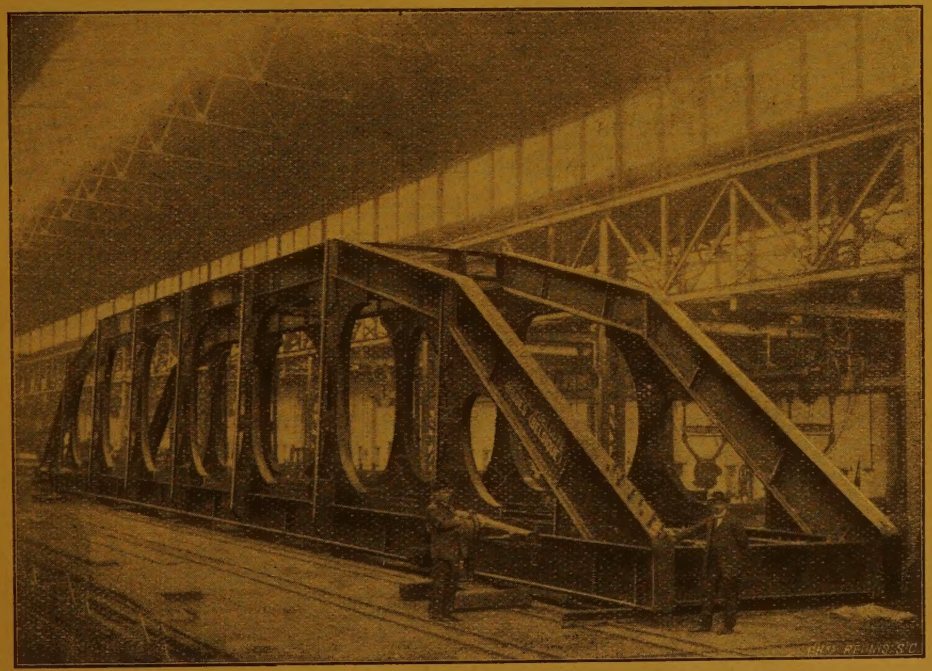

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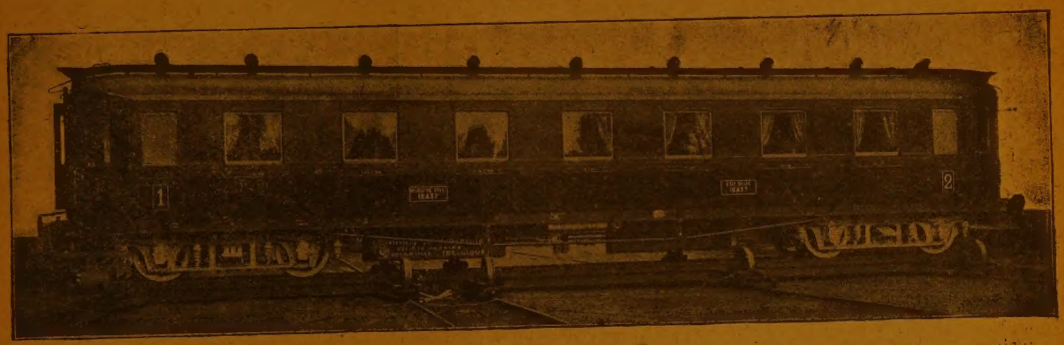

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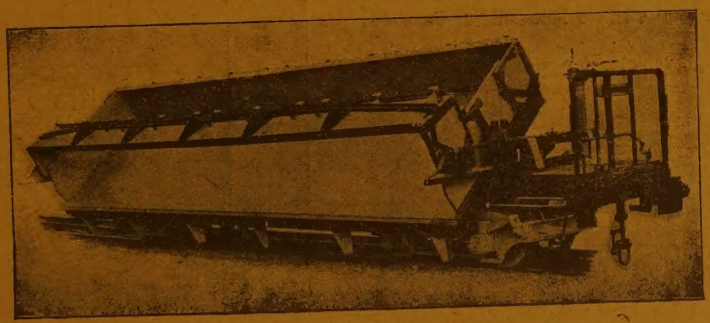

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